MILITARY PRODUCTS FROM COMMERCIAL LINES

VOLUME I - BUSINESS PRACTICES IPT

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1 Executive Summary

This report details the results of the Business Practices activities of the Military Products from Commercial Lines (MPCL) project. MPCL demonstrates the production of military electronics products on commercial manufacturing lines, showing cost reductions, improved quality and equivalent performance. The project has resulted in an expanded military manufacturing base, obviating current trends of diminishing manufacturing sources for military products. MPCL consists of three major activities:

- Process Technologies (PT) involves the design and production of avionics modules.
- Manufacturing Infrastructure (MI) involves creating the computer systems that allow for integration of design and production environments as well as flexible production cells that allow for seamless transition from commercial products to military products.
- Business Practices (BP) involves developing the contractual and operational mechanism to integrate a military customer and a commercial supplier.

The Business Practices activity operated during the whole four-year tenure of the MPCL project. From the beginning, attacking business practice barriers was the project's highest priority. Commercial companies simply would not do business under the traditional military acquisition system; therefore, developing new process technologies or manufacturing infrastructures would be fruitless unless business practice barriers could be overcome.

The success of this activity has been striking. Business practices developed under this program are serving as a model for streamlined acquisition and for implementation of a commercial alternative to Military Standards.

1.1 Accomplishments

MPCL has changed the way military and commercial contractors view each other. From the military perspective, commercial contractors are now seen as sources of high quality products and significantly reduced prices. Military contractors have bought into the idea that commercial quality control processes provide more than adequate replacements for Mil-Stds and Mil-Specs. This realization came about after testing conducted under the PT activity. The MPCL project has replaced perceptions with facts, thus overcoming much of the fear experienced by commercial suppliers when contemplating doing business with the military. MPCL has convinced both sides that there can be a win-win scenario.

MPCL has provided products to enable a successful merger of the military and commercial business practices paradigms. The two primary products are a Model Subcontract and Business Practices Manual. The Model Subcontract provides a template from which a military buyer and commercial seller can arrive at mutually agreeable terms and conditions. The MPCL Business Practices Manual provides alternative to Mil-Standards and Mil-Specifications. It is based on ISO-type processes; therefore, commercial companies feel quite comfortable with the general approach.

Electronic versions of the Model Subcontract and Business Practices can be found on the ASC Acquisition Desk Book web site.

1.2 Opportunities

MPCL has helped create a new future that offers military products at reduced cost and improved quality and with less susceptibility to parts obsolescence. This future is possible because MPCL has opened up the supplier base to commercial sources. Conversely, commercial contractors, especially small companies, can do more business with military contractors and the Government. Companies that already operate with a large product mix and small lot sizes will find military products to be a very valuable source of revenue. Acquisition reform can become a reality.

1.3 BP Activities Summary

The BP Activity, like the entire MPCL project, was divided into three phases. In Phase I, new business practice concepts were developed. Business practices were parsed into two types – contractual and technical. Activities on the contractual and technical BPs proceeded in parallel, with separately operating IPTs. The analysis of the contractual BPs resulted in the draft Model Subcontract, while analysis of the technical BPs resulted in the Business Practice Manual. In Phase II, demonstrations of the new BPs were conducted. The Model Subcontract was demonstrated by negotiating a contract between TRW Avionics System Division (ASD) and TRW Automotive Electronics North America (AEN). The BP Manual was demonstrated through vigorous review by the BP IPT. Phase II focused on the MPCL project participants while Phase III broadened that focus to additional commercial suppliers. The activities of Phase III, therefore, endeavored to validate the findings of MPCL with commercial electronics suppliers. Summaries of the activities of MPCL phases are found in Sections 2, 3 and 4, respectively.

2 PHASE I

Phase I involved analyzing military and commercial business practices to understand the barriers to integration. The analysis led to initial recommendations for a Model Subcontract and BP Manual, as well as several new processes.

2.1 Phase I Background

A fundamental premise of the MPCL project was that some Government business practices act as barriers to the integration of the defense and commercial industrial bases. The following business practices were identified as major barriers.

- Military – unique product and process specifications and standards. Military specifications were adopted to ensure DoD received a quality product that would meet the user's needs while using a procurement process that would allow DoD to purchase from the lowest bidder, to ensure standardization and to enable ease of logistics support.
- Unique Government cost accounting standards. Cost Account Standards (CAS) were adopted to provide accounting criteria that would result in comparable costs

for like circumstances within a company and to ensure contractors properly allocated costs to DoD contracts. Complying with these standards requires installing a CAS-compliant accounting system.

- Requirement to provide product cost data. Cost or pricing data requirements were established to ensure the Government received the same information the contractor had, for use in negotiating a fair and reasonable price
- Audit and oversight requirements. These were established to assure specific compliance with technical and financial systems and to assure fair value in Government procurements.
- Socioeconomic and mandatory source requirements. These were added to ensure knowledge of and compliance with the public laws.
- Requirements for rights to technical data. Rights in Technical Data have been requested to ensure the Government can operate, repair and maintain its equipment without fear of being held hostage to a sole-source supplier for spare parts and to obtain additional equipment and parts at reasonable prices through competition.
- Security requirements. These were established to ensure national security.

Due to the above barriers, commercial suppliers have not viewed the Government as a preferred customer. In addition, the instability of requirements and budgets, the Government's right to terminate contracts at will, and the risk of incurring criminal or civil penalties by inadvertently failing to comply with a Government rule or regulation are further reasons that many companies avoid DoD business.

2.2 Phase I Objectives

The overall objective of Phase I was to develop an approach to business practices that overcomes the current barriers to building military products on commercial lines.

2.3 Phase I Approach

An IPT approach was adopted for the BP activity. The BP IPT included members from multiple organizations and disciplines to include TRW Avionics Systems Division (ASD), TRW Automotive Electronics North America (AEN), Air Force Manufacturing Technology, Army Manufacturing Technology, Lockheed Fort Worth Company,

Lockheed Aeronautical Systems Company, F-22 SPO, RAH-66 PMO, Rome Laboratory , Aeronautical Systems Center and the Comanche Joint Program Office (Sikorsky and Boeing Helicopter). The disciplines included design, manufacturing, component and quality engineering, procurement, business and finance, and integrated logistics support. This organization was required because of the broad range of subjects covered under BP and because of the large number of Government and contractor parties involved. A structured methodology was adopted by the IPT as shown in Figure 2-1.

Figure 2-1. The BP Activities Followed a Structured Methodology

The methodology consisted of five steps: Identification, Analysis, Recommendations, Demonstration and Transfer. The first three steps, Identification, Analysis and Recommendations, were accomplished in Phase I. Demonstration was done in Phase II and Transfer in Phase III.

Identification was the data gathering and parsing step. The challenge of the BP IPT was to review and evaluate the universe of military and commercial BPs in a systematic process to identify the areas of greatest interest and payoff. The starting point was the existing F-22 contract, which represented a typical military contract, and

a typical TRW AEN contract. The initial review resulted in a taxonomy of BPs as shown in Figure 2-2. The figure also shows a first order comparison of the relative numbers of BPs in the respective military and commercial categories. Once the BP categories were developed, they were analyzed using two methods: 1) a macro-comparison of relative costs of a military and a commercial enterprise developing the same product and 2) a Quality Function Deployment (QFD).

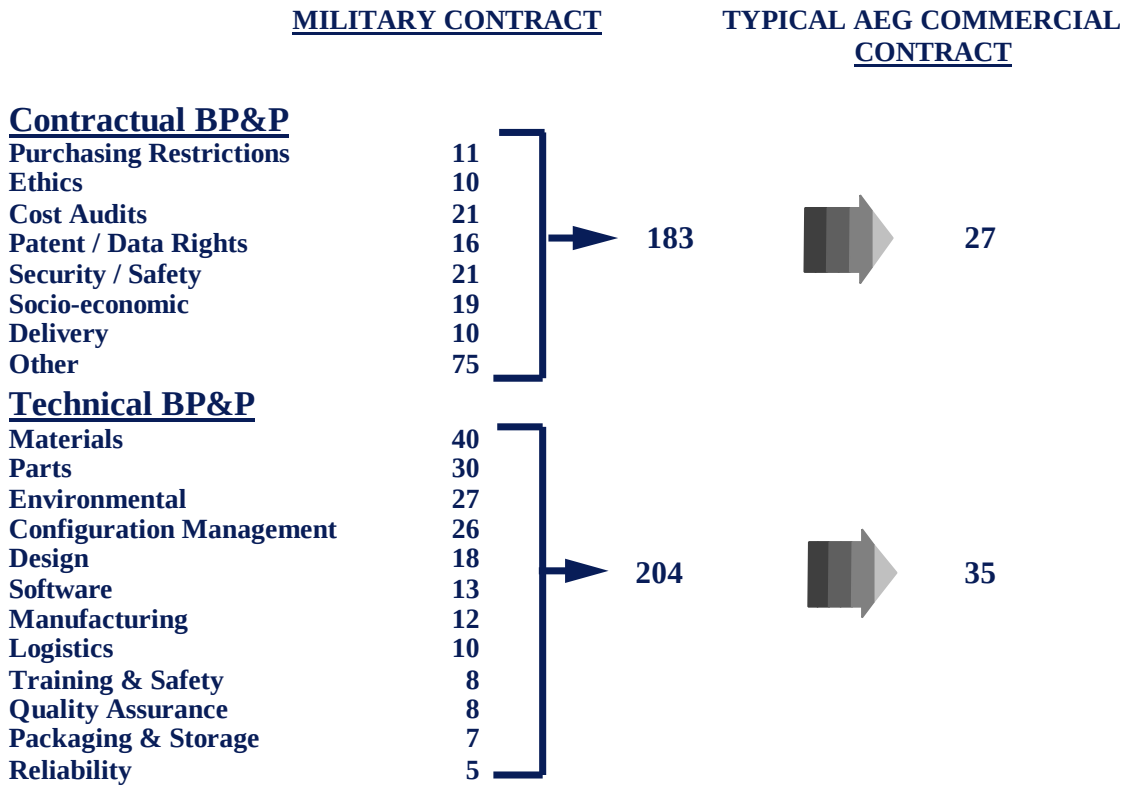


Figure 2-2. Initial Taxonomy of BPs

The macro comparison involved comparing the relative costs to TRW ASG and TRW AEN of producing the Apache helicopter Inflatable Body and Head Restraint System (IBAHRS) crash sensor. IBAHRS is a helicopter airbag, so the product was very familiar to TRW AEN which builds automotive airbag sensors. The results, shown in Figure 2-3, showed an overall cost differential of 79%. The components of the cost difference served to point to BP categories that should be addressed. Material cost differences can be attributed in large part to parts selection and control processes. Labor cost differences can be attributed in part to inspection requirements. The

commercial labor savings is more attributable the high degree of automation available to TRW AEN. This is also reflected in the differences in tooling. This problem is being addressed by designing the modules for the existing automation. Overhead differences can be attributed to labor and systems required to service contractual BPs and some specific technical BPs such as quality.

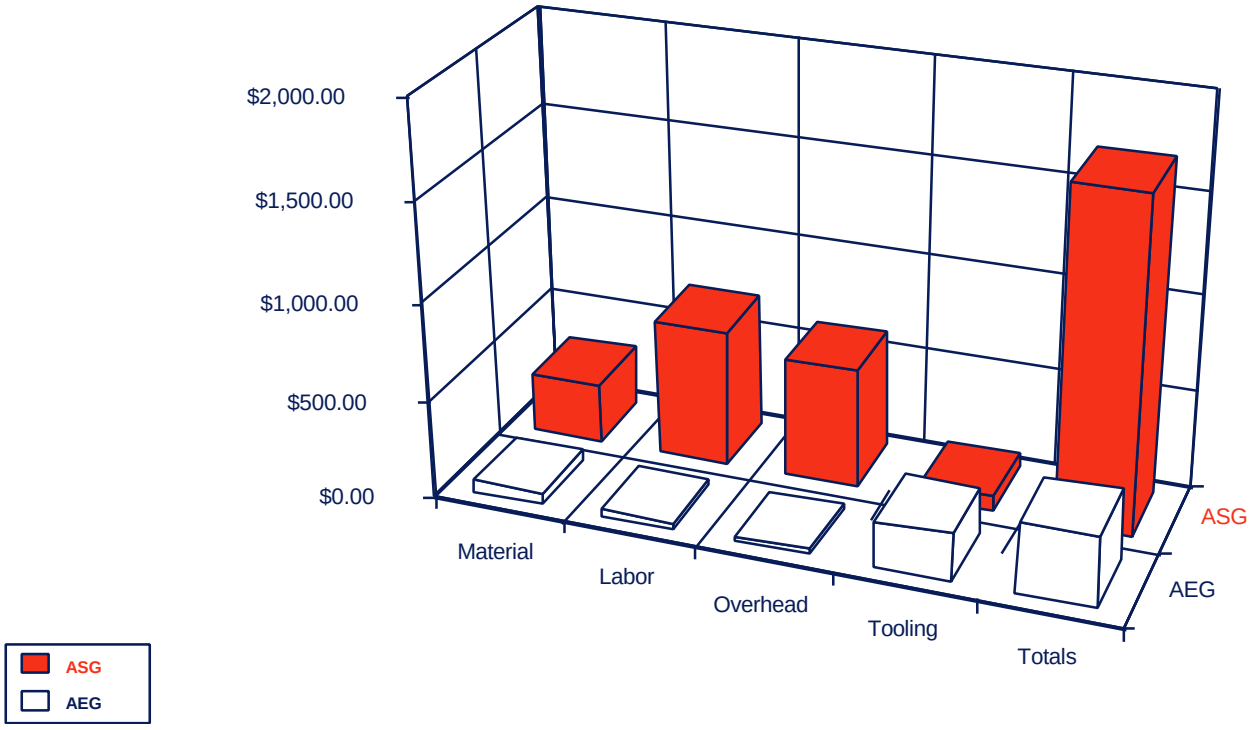


Figure 2-3. Macro Comparisons

The IBAHRS study provided a top-down comparison of costs and categories of BPs that drive costs. The QFD provided a bottoms-up ranking of the BPs by category. The top ten ranked BPs resulting from the QFD, shown in Figure 2-4, highlight the importance of design-related BPs and correlate with the IBAHRS study.

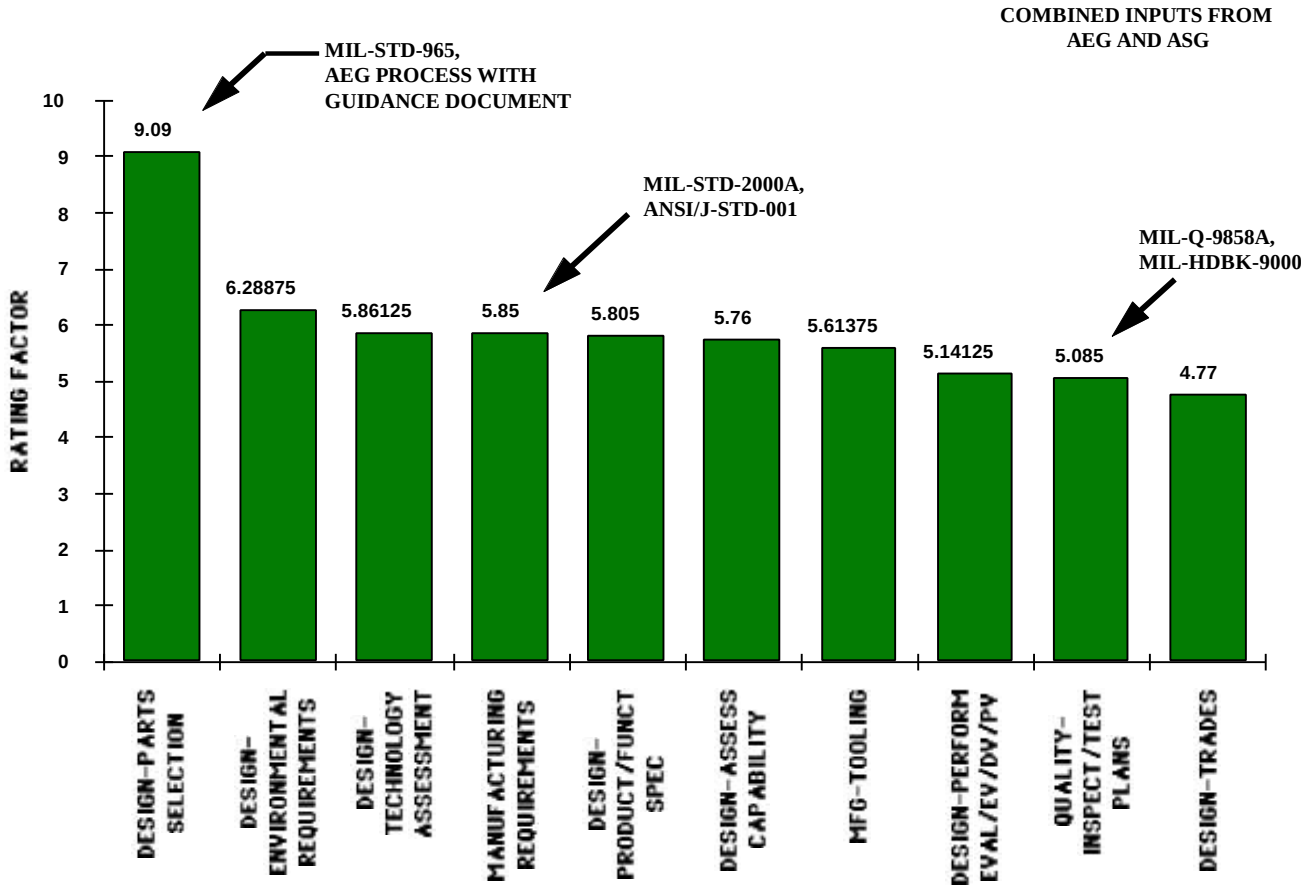


Figure 2-4. QFD Top Ten Chart

The **Analysis** step looked at each of the functional categories, comparing military to commercial processes, with the commercial process the "to be" model, resulting in initial recommendations. Emphasis was placed on developing metrics.

Recommendations are working hypotheses developed by the IPT that must be validated with data from MPCL demonstrations or outside sources. The primary recommendations are for the creation of a BP Manual and Model Subcontract. Recommendations are described in Section 3.

Demonstrations are the mechanism to validate the recommendations. This is the process pursued in Phases II and III. A key demonstration for Phase II was the execution of a new subcontract with TRW AEN to validate the Model Subcontract. Included in this demonstration is an evaluation of the usefulness of the BP Manual. In Phase III, the new subcontract was expanded for broader applications and transfer.

Transfer is the process of institutionalizing the recommendations with the program partners or other commercial or Governmental organizations outside the pilot. The adoption of the BP approach demonstrated on the pilot by mainstream acquisition programs would be a successful transfer.

2.4 Phase I Accomplishments

As a result of the analysis and identification steps, three high priority recommendations were made in Phase I. Two of these recommendations addressed technical requirements: Quality Systems and Parts Control and Selection. The third addressed a mechanism for integrating military and commercial contractual requirements.

2.4.1 Quality Systems

The Quality Systems analysis and subsequent recommendations were driven by the requirement to develop a quality system acceptable to commercial companies that would provide commensurate quality to the military customer. Quality standards such as ISO were seen as the model. Specific recommendations were to:

- Include in the BP Manual, the Quality Assurance requirements for Government products. These requirements shall be satisfied by an acceptable Quality System that is based on the ANSI/ASQC Q9001-1994, ISO-9001 or ISO-9002, as appropriate.
- Include tailoring of the Quality System as may be required, only when a higher level of quality is required due to the complexity of the product.

2.4.2 Parts Control and Selection

The Parts Control and Selection recommendation was based on the use of existing commercial practices. Adoption of this recommendation should result in significant parts approval cycle-time improvements as shown in Figure 2-5. Figure 2-5 points out that the commercial company, TRW AEN, takes 76 more days for the supplier survey, yet still requires 57 days less in total. This example underscores the importance that commercial companies put on developing alliances. To realize these cycle-time savings, the IPT recommended that commercial parts suppliers be allowed to use their existing parts control and selection processes. Their existing processes should be supplemented by

military customer guidance documents for unique cases only. The lean principle advocated by the BP IPT is to give suppliers more authority in managing their quality and performance of their product. In other words, let the supplier assume the full responsibility for determining the acceptability of components for their products.

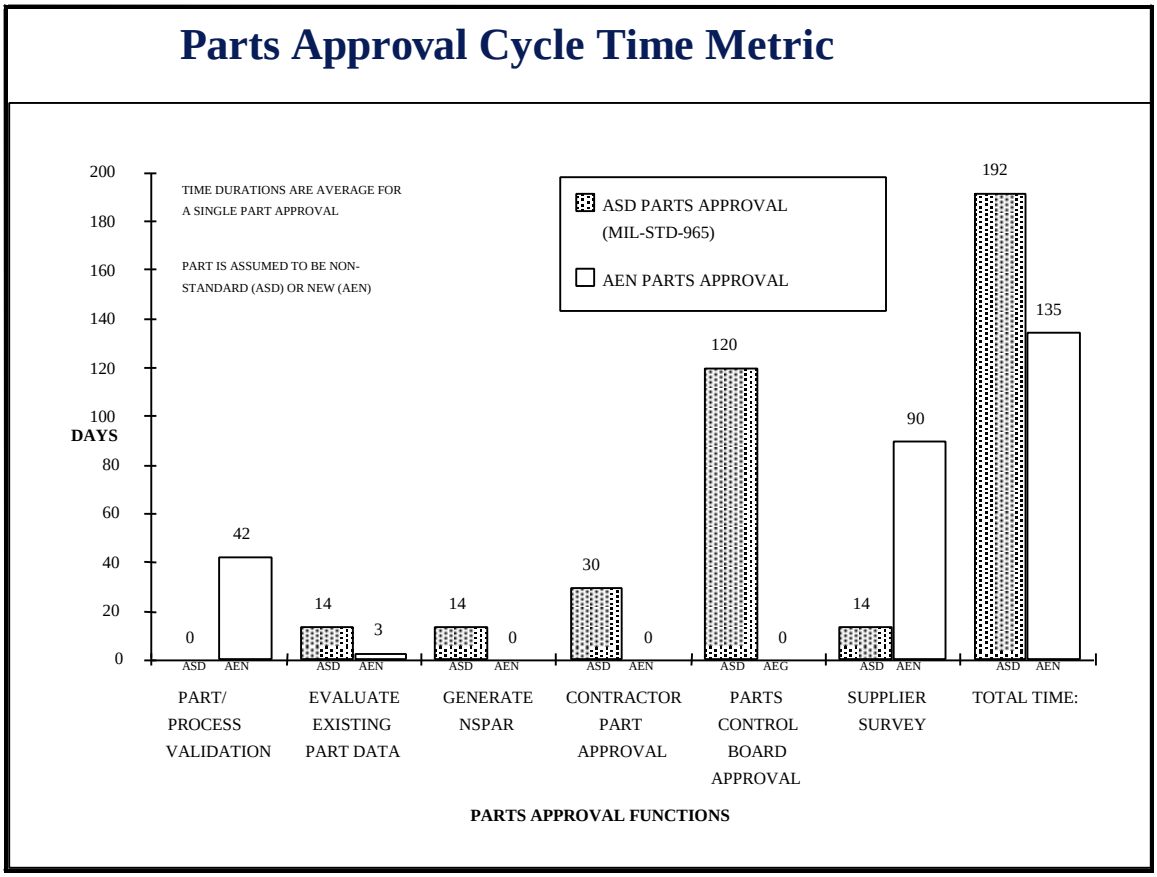


Figure 2-5. Parts Approval Cycle Comparison of Military and Automotive Processes

2.4.3 Contract Regulations

The overall approach for the MPCL BP activity is based on allowing military contractors to work seamlessly with commercial contractors. Key to this activity is a new approach to contracting, both from legal perspective (terms and conditions) and from a technical perspective (SOW, specifications, etc.). The approach also assumes that the Government and industry are partners in the development of products.

It is absolutely essential that significant changes be made to the standard way of Government contracting if commercial companies are to be expected to bid on

Government contracts. Based on the preliminary BP findings, the most desirable and efficient way to accomplish this was to require the absolute minimal amount of "Government-type" Terms and Conditions, specifically FARs and DFARs. Any clauses that are imposed in Government contracts must be very similar to, or the same as, the clauses used by commercial business if they are to be readily accepted by commercial companies. TRW AEN was adamantly opposed to accepting any clauses that were out of the realm of their standard commercial clauses for three reasons: (1) cost associated with compliance, (2) the disruption to their way of doing business, and (3) the perceived risk of proprietary information reaching their competitors. The Government must be willing to change its contracting philosophy, relying on commercial type contract requirements to ensure fair value without imposing the overwhelming number of oversight clauses that they currently require.

The Government and commercial contractors have very different approaches to contracting. The Government's approach appears to be driven by a perception that contractors cannot be trusted. To protect itself, the Government chooses to impose clauses to cover any possible situation and provide the broadest range of rights. Commercial companies rely on competition and established business relationships to ensure a fair value. A typical Government contract may consist of from 75 to over 100 clauses, while a TRW AEN contract normally consists of only 27 clauses. Another contributing factor to the clause count differences is the requirement for socioeconomic type clauses in Government contracts. Government contracts include dozens of clauses that mirror requirements of public law and Executive Orders. These types of clauses are not found in commercial contracts. However, since the socioeconomic type clauses are based on requirements imposed by public laws or Executive Order, commercial companies are required to comply with the basic intent of these programs whether or not they are called out in the contract. Putting these clauses in the contract is therefore redundant and results in costs associated with tracking compliance. Eliminating this duplication results in significant reduction in the recommended FARs and DFARs.

The MPCL strategy was to incrementally evolve to a contract that is acceptable to commercial contractors, but does not give up fundamental Government rights. The

mechanism that showed the most initial promise was the use of DFAR 211.70 - "Contracting for Commercial Items." DFAR 211.70 provides a process for commercial companies to provide goods under Government contracts. Under this DFAR, “Commercial Items” are items regularly used in the course of normal business operations for other than Government purchases which:

(1) Have been sold or licensed to the general public,

(2) Have not been sold or licensed, but have been offered for sale or license to the general public,

(3) Are not yet available in the commercial marketplace, but will be available for commercial delivery in a reasonable period of time, and

(4) Are described in paragraph (1), (2) or (3) that would require only minor modification in order to meet the requirements of the procuring agency.

By using the Commercial Item Definition and eliminating duplication, the total number of clauses required can be cut to three: 52.222-26, Equal Opportunity (Apr 1984), 52.222-35, Affirmative Action for Special Disabled and Vietnam Veterans (Apr 1984), and 52.222-36, Affirmative Action for Handicapped Workers (Apr 1984).

If the commercial item definition is met, commercial companies can supply goods and services to the government without the burden of the excessive quantity of Terms and Conditions that are normally found in military contracts. Conversely, the Government can expect 1) a simplified procurement process that encourages more commercial suppliers to pursue government contracts, 2) decreased procurement costs as a result of streamlined processes and increased competition and 3) reduced product delivery times.

2.5 Phase I Summary

Phase I laid the groundwork for future BP activity. The IBAHRS study showed the quantitative differences in the costs of doing business in the military versus commercial environment. The analysis of the technical BPs concluded with a recommendation to proceed with a commercial standards alternative to Mil-Standards and Mil-Specifications. The analysis of the contractual BPs resulted in the potential use of the Commercial Item

Definition to drastically reduce the number of mandatory clauses, and make Government contracts acceptable to commercial suppliers.

Phase II and III of the MPCL built on the above findings, developing and validating BP products and processes geared to military-commercial integration.

3 Phase II

3.1 Phase II Background

The BP Phase I activity concentrated on analysis of the "as is" conditions in both military and commercial business practices. Given that baseline, Phase II focused on defining and demonstrating the "to be" model of what is needed to develop military products on commercial lines.

3.2 Phase II Objectives

Phase II objectives were to further refine the recommendations of Phase I, develop products and processes that resulted from the recommendations and demonstrate the efficacy of the products and processes.

3.3 Phase II Approach

Integrated Support Teams (ISTs) were formed for technical process requirements (design, configuration management, quality, manufacturing, etc.) and contractual terms and conditions, respectively. The ISTs included representatives from TRW ASD, TRW AEN, Lockheed, Boeing, the F-22 SPO, the RAH-66 PMO, Air Force Manufacturing Technology Directorate and industry association representatives. The ISTs reviewed existing military and commercial processes to arrive at a consensus on mutually acceptable practices.

During Phase II, the Technical BP IPT focused on developing a BP Manual that was in line with approaches used in both government and industry. The emphasis of the Contractual BP IPT was the development of a Model Subcontract.

3.4 Phase II Accomplishments

BP tasks during Phase II focused on developing and refining the Business Practices Manual and the Model Contract. In addition to these tasks, a series of efforts were conducted to demonstrate the efficacy of the new business practices that were being incorporated into the BP Manual and the Model Contract. The demonstrations included the following:

- Attaining commercial item status for the MPCL modules supplied by AEN.
- Completing a price analysis on the MPCL modules to establish a basis for fair and reasonable pricing by AEN.
- Developing an agreement to transfer the modules from Mantech to the F-22 and RAH-66 programs upon completion of module functional and durability tests.
- Assisting the PT and MI teams with purchasing restrictions encountered during Phase II.
- Implementing a model contract with TRW AEN for MPCL modules.

A description of the BP Manual development and the demonstrations follow.

3.4.1 BP Manual

The technical business practice task focused on the development of a BP Manual. The BP Manual is set of requirements that define a process to assure the development and production of high quality products. The BP Manual replaces Mil-Standards and Mil-Specifications. The BP Manual was divided into functional areas described below. The complete BP Manual is available through the ASC Acquisition Deskbook. These functional areas were derived from the analysis of Phase I.

Management

A key management technique is the use of Integrated Product Teams (IPTs). These are deemed a crucial part of the design process, as well as many other successful business practices. The intent of the teams is to consider all viewpoints, both buyer and seller, as well as the engineering, manufacturing and procurement communities.

Design Control

Design control includes the following topics: definition of key design characteristics, use of multifunctional design teams, focus on customer requirements, design controls, design development plans, design reviews, Design Failure Modes and Effects Analysis (DFMEA), the design verification process, and the design validation process.

Parts Control

The Parts Control Program is an industry "Best Practice" for the initial selection and replacement of obsolete parts during the product life cycle. This program places emphasis on the IPT involvement in the evaluation of various technologies, identification of key characteristics, performance characteristics, quality, reliability, and maintainability, the collection and use of parts performance information and the customer notification of product phase-out.

Configuration Management

The BP Manual CM process represents a combination of ISO and military requirements.

In this area, the military configuration management requirements proved very useful, especially in the area of documentation. TRW AEN felt that the military CM requirements were an improvement to their existing process and incorporated them prior to their QS-9000 certification.

Quality Systems

The development of Quality System requirements was among the more controversial efforts. The team that participated in the development process included a cross-section of military and commercial participants. Initially, requirements were perceived to favor the military requirements at the expense of commercial practices. The disagreement among IST members focused on the Cost of Quality reporting requirements. The F-22 SPO argued that quality cost reports are a key basis for the SPO's negotiation position with F-22 contractors in production bids. It therefore followed that if TRW AEN was to provide hardware to the F-22 SPO in the future, they would have to agree to report quality costs.

The AEN position was that cost of quality reports were generated for internal use and were not provided to customers due to competitive advantage concerns. AEN would agree to permit the F-22 customer to review examples of internal cost of quality reports which are based on production lines or processes, but would not generate them for MPCL modules specifically. Continued discussions and clarifications resulted in a mutually agreeable solution. After a more complete definition of the requirements, the AEN participants realized that they were already meeting the intent of the requirements. With some tailoring, approval of the requirements followed.

Supplier Selection

The entire BP Manual can be seen as a set of supplier selection requirements identifying best practices and providing a basis for the evaluation of potential supplier processes. This chapter of the manual identifies the practices that industry uses to identify, evaluate, and work with their sub-tier suppliers.

Customer Property Controls

The customer property controls requirements are based on commercial practices. FAR-Part 45 requirements were deemed to be too onerous to commercial suppliers. As an early example of transition, MPCL requirements were used as inputs to the FAR – Part 45 re-write process.

Procurement Controls

A key issue in this area involved the military requirement known as DPAS (Defense Priorities and Allocations System). DPAS requires including a written notice on the face of the purchase order that informs the supplier that this order was subject to the provisions of DPAS. These provisions require suppliers to adhere to a priority scheme in the event of a national emergency or urgent military need. TRW AEN agreed that it could include the text of such a written notice in its purchase orders without major expense or inconvenience.

Packaging, Shipping, and Handling

MPCL requirements in the packaging, shipping and handling area are true best commercial practices. The requirements place the responsibility for these functions with the supplier and allow full flexibility and accountability for meeting the requirements. These requirements include responsibilities for procedures, storage controls, labeling, bar coding, preservation and packaging that are acceptable to both commercial suppliers and government customers.

Production Control

Production Control requirements were a subject of debate among the members of the IST. Specifically, some members felt that there was no need for burdensome process control requirements for a competitive fixed-price commercial item contract. Several other team members felt that the inclusion of best practices in process control was beneficial. The final result included the best practices.

Product Support & Logistics

Much of the attention of the team was focused on the issues of Diminishing Manufacturing Sources and Material Shortages (DMSMS) and Contractor Logistics Support (CLS). Two phenomena related to the reductions in defense spending were that parts suppliers to the military were leaving the market and the military was closing bases. This team identified some best practices for dealing with obsolete parts and the parts selection process to help mitigate the problems of a shrinking defense supplier base. Additionally, the team addressed the key factors necessary to implement CLS as an alternative to organic base support to military systems.

Reliability

Much of the reliability analysis done by the IST focused on a comparison of commercial practices to military practices. The key difference noted between commercial and military reliability practices center on volume and specifications. Commercial firms perform extensive tests on a large number of sample parts. This can be done because the parts are relatively low in cost and the benefit gained from large sample size testing is a

more accurate prediction of reliability. Military firms generally cannot perform tests on large sample runs, so there is a greater emphasis on modeling tools to predict reliability. Along with these tools there are a number of specifications for use that drive military firms into high cost, analytical reliability engineering programs. The IST ultimately agreed to avoid the use of "how-to" specifications for analysis, and instead, empowered the supplier to describe its reliability program in the form of reliability procedures and plans.

Operational Requirements Matrix

Many of the handbook requirements are intended for use only when the situation warrants. For example, the design control requirements section would generally not be required of a supplier who is not performing design process. Therefore, it was decided to supplement the manual with a matrix that allows the user to selectively apply those sections of the handbook to a given project. This matrix lists all of the BP Manual requirements in an abbreviated format with boxes to check indicating applicability. The matrix is to be completed by a customer.

3.4.2 Commercial Item Status

From the results of Phase I, the plan was to base the Model Subcontract on a reduced set of FARS/DFARS, resulting from the Commercial Item Definition. This approach did not work out, however. At the beginning of Phase II, the use of the Commercial Item Definition approach was disapproved by the Air Force, pending additional justification. Given that the approval for the use of the Commercial Item Definition was far from certain, the Contractual BP IPT had to pursue an alternative approach while holding out hope for the eventual approval of the Commercial Item Definition. Proceeding on that basis, the IPT first parsed the traditional military contractual regulations and terms and conditions into the following categories: Delivery & Inspection, Limitation of Liability, Socioeconomic, Ethics, Patent/Data Rights, Purchasing Restrictions, Cost or Pricing Data, Audit, and Miscellaneous Clauses. For each category, the IPT compared the government's intent to the prevailing commercial practices. The objective was to arrive at some mutual agreements on contractual requirements and terms and conditions. Initially, the IPT operated without the support of attorneys. During a review of the MPCL

program by the Government Accounting Office (GAO), a recommendation was made to include attorneys in the review cycle for the documents published by the team. A team of attorneys from the law firm Fried, Frank, Shriver, & Jacobson was hired to do the basic legal groundwork. TRW AEN staff attorneys provided commercial practice inputs. From the preliminary review of the clauses, it appeared that trying to resolve the gulf between military and commercial contracting practices would be lengthy, if not impossible. This was due to the statutory nature of many of these clauses. There was little recourse for one seeking relief other than to recommend legislative changes or request waivers. This clause by clause analysis was terminated, however, when the strategy employing the Commercial Item Definition was approved by the Air Force. This approval, described below, was a major breakthrough.

In May 1996, a justification for defining MPCL products as commercial items within the guidelines of the revised FAR definition was submitted to Wright Lab (WL) Contracting for a determination and finding. While justification memoranda are commonplace in the procurement world, this document was unique in that it was the first attempt to define a military-unique product as a commercial item. The justification focused on making the case that the process for building the military item was the same as for building commercial items. The argument was possible because of key language for " items of a type" and "modifications of a type" that had been added to the definition of commercial items by the Federal Acquisition Streamlining Act (FASA). The MPCL modules are similar in type to modules made by AEN for its commercial customers. The modifications made by AEN to its process to accommodate the MPCL modules were similar to the line modifications the firm makes for its commercial customers. These two facts were key in obtaining concurrence for the commercial item status.

While the FAR permits a Contracting Officer (CO) to make such a determination without assistance or consultation, a Determination and Finding (D&F) was presented to the Judge Advocate General (JAG) representative for an opinion. This was done to establish a legal precedent and to satisfy an F-22 SPO desire to have a JAG-confirmed determination that the modules were commercial items. Ultimately, the JAG declared the WL D&F legally sufficient. During September 1996, the MPCL contract was modified to

add the FAR Clause 52.244-6 that prescribes the subcontract flow down requirements for commercial items.

A subsequent meeting was held with the TRW Administrative Contracting Officer (ACO) to brief him on the contract modification and enlist his understanding and support. He concurred with the approach and endorsed a decision to establish a second commercial item subcontract on MPCL with Maxim for semiconductor components. The rationale for determining Maxim's subcontract to be commercial was similar to that used for AEN. The process used by Maxim for military parts is identical to that which is used for its commercial customers.

A more detailed discussion of the Commercial Item Determination can be found in the Appendix D.

3.4.3 Price Analysis

After the commercial item determination was made, the next step was to conduct a price analysis of the MPCL modules. The price analysis was a mechanism to assure the Government that it was getting a fair and reasonable price. The price analysis was also specifically needed to get a complete exemption from cost or pricing data requirements. This exemption would allow AEN to procure material for PV modules. Up until this time, the plan was for ASD to procure material and furnish it to AEN for manufacture of the modules. This was a work around arrangement to avoid cost and pricing data requirements to AEN. Allowing AEN to buy the materials would follow their current commercial model, thus more fully meeting the objectives of building military products using commercial processes.

The price analysis approach was to compare MPCL modules to commercially available items of similar function and complexity. The chosen items were commercial digital signal processing modules. These items were available on published price lists at prices comparable to estimated MPCL module prices.

In order to complete the price analysis the BP team had to obtain a bid from AEN for the Production Verification (PV) modules. An RFQ and bill of materials were sent to AEN during November 1996. The process of obtaining the AEN quote was slow due to the novelty of bidding a military product. When the BP team received the bid in February

1997, the prices of the commercially equivalent modules had decreased dramatically in price. The result was that these items were no longer within 25% of the AEN price. An alternate approach to determining the AEN price to be fair and reasonable had to be found. Much of the price of the MPCL modules was due to application-specific integrated circuits (ASICs). Taking ASICs out of the price equation would allow a more "apples to apples" comparison since the commercial modules did not have high priced ASICs. When the ASICs were discounted, the MPCL modules were found to be reasonably priced when compared to the equivalent commercial modules. A more complete discussion of the Price Analysis process can be found in the paper "Pricing: A Major Hurdle in Acquisition Reform (Appendix C to this document).

3.4.4 Transfer Agreement

Early in Phase II, the F-22 and RAH-66 customers began to develop plans to use MPCL modules in their Engineering and Manufacturing Development (EMD) and Demonstration/Validation (DEM/VAL) phases. To ensure that there would be a smooth transition of the required hardware and technical data, the BP team initiated a transfer agreement for the F-22 program. RAH-66 had earlier added the MPCL modules as government furnished equipment (GFE). A draft memorandum of agreement for transfer of MPCL modules to F-22 for use on the EMD program was initiated in May 1996. The agreement was revised through several review processes at Lockheed, Wright Lab,the F-22 SPO and TRW. A key issue was determining a date (March 1997) as to when the decision would have to be made to use the MPCL modules and discontinue processing the F-22 baseline modules. Processes were also necessary to handle changes to MPCL hardware or documentation after the decision date.

The final version of the transfer agreement was sent out to the F-22 SPO, the Air Force Manufacturing Technology Directorate (ManTech), Lockheed and TRW for coordination prior to signoff. As of October, 1996, the F-22 SPO had completed coordination and was ready to recommend signoff by the Director. The ManTech review/coordination was well underway and nearing completion. During November, TRW ASD signed the transfer agreement. The agreement was then sent to Lockheed for signatures of the LMTAS and LMAS Vice Presidents. While at Ft. Worth, questions

were raised by Lockheed contract personnel as to the need for a transfer agreement. Their position was that the F-22 contract modification that authorizes Lockheed to use MPCL modules vs. F-22 baseline modules accomplishes the intent of the transfer agreement and was more contractually binding. On this basis, Lockheed declined to sign the agreement. However, the Air Force Wright Laboratories Manufacturing Technology Directorate, TRW and the F-22 SPO signed the final agreement as a show of good faith that the MPCL modules would be used by the F-22 assuming they passed key test milestones.

3.4.5 Resolution of Purchasing Problems

The BP team helped overcome significant problems placing orders for Design Validation (DV) material. For example, IBM would not accept mandatory FAR/DFARS clauses on two purchase orders for DV. IBM is a sole source supplier since they were the only bidder out of ten vendors solicited for the ball-grid array (BGA) packaging orders for Motorola ASIC die. The IBM law department recommended that the orders not be taken if FAR/DFARS clauses were imposed. IBM management, however, indicated that they were interested enough in the work that MPCL represents that they would accept the orders despite the advice of their law department. The mandatory clauses were accepted and the contract was put in place during August.

Additional support was required on MPCL procurement efforts that were stalled due to contractual issues between TRW and commercial suppliers. An order for software development services was held up when the supplier (ITI-International TechneGroup Inc.) threatened to move the work to their government services division based upon the required MPCL FAR/DFARS flow down clauses. This would have set back the development effort severely as much work had been done previously between the commercial division of ITI and AEN. During discussions, ITI revealed that the overhead rates in its government subsidiary are 30% higher than in its commercial subsidiary, owing to a large accounting staff to deal with government regulations. To resolve, TRW issued a commercial contract to ITI without the flow down clauses, since the services were performed by a commercial organization and were the same as performed for other commercial companies.

Another PT supplier, Maxim, was adamantly opposed to accepting the Defense Priorities and Allocation System (DPAS) flow down. Maxim had a previous customer invoke their DPAS priority, thus disrupting their more profitable commercial products. To resolve the issue, a determination was made that the parts were commercial items, this the DPAS flow down was not required.

3.4.6 Model Contract Development

With the completion of the commercial item status determination and the price analysis, the BP team focused its attention on the implementation of a change to the AEN subcontract. The major portions of the change are outlined below:

- Add the procurement of necessary materials to complete the manufacture and delivery of 47 Front End Controller Modules (FECs) and 77 Pulse Narrowband Preprocessors (PNPs).
- Explicitly list these 47 FECs and 77 PNPs as deliverable items to TRW ASD.
- Incorporate the MPCL Handbook into the subcontract as the business practice requirements.
- Remove all existing FAR clauses with the exception of the following: 52.222-26 Equal Opportunity (Apr 1984), 52.222-35 Affirmative Action for Special Disabled and Vietnam Era Veterans (Apr 1984), 52.222-36 Affirmative Action for Handicapped Workers (Apr 1984).
- Establish the AEN subcontract as a commercial item subcontract.
- Include the same foreign source restrictions as the MPCL prime contract. These restrictions are necessary due to the nature of the F-22 and RAH-66 export restrictions. A proposal was submitted to the F-22 prime contractor Lockheed to consider removal of the foreign source restrictions for some non-sensitive MPCL components.

The revised AEN subcontract serves as a template for a model subcontract useable by other programs.

3.5 Phase II Summary

The business practices demonstrations provided practical lessons learned on how to implement acquisition reform. These lessons learned laid the groundwork for establishing

the processes for developing military processes on commercial lines. By the end of Phase II, the MPCL BP IPT had achieved the following:

- Developed the BP Manual as a workable alternative to Mil-Standards and Mil-Specifications.
- Established the precedent for the use of the Commercial Item Definition for the development and manufacture of military products from commercial sources. This precedent will open the door for commercial companies to respond to military solicitations.
- Using the Commercial Item Definition as a basis, developed a Model Subcontract that can be used for acquisition of military items from commercial suppliers.
- Executed the model subcontract with TRW AEN for the delivery of MPCL modules.

4 PHASE III

4.1 Phase III Background

As a result of the Phase II BP activities, the MPCL project had business processes and products that were focused on building TRW F-22 and RAH-66 electronics on a TRW automotive electronics line. These results, albeit very important, could not be assumed to be directly transferable to other programs. Phase III addressed this situation, validating the processes and products developed previously and making the results more accessible to a broader segment of the electronics community.

4.2 Phase III Objectives

The objectives of Phase III were validation and dissemination of the MPCL business practices. First, the team desired to validate the business practices and products developed during phase II of MPCL with other commercial companies. Second, the BP team disseminated the MPCL BP concepts to a broader segment of industry through the ASC Acquisition Desk Book project and specific technical interchanges.

4.3 Phase III Approach

The BP team formulated its Validation and Transfer strategy with the input of each primary beneficiary of the program. Both the direct customer, Air Force Research

Laboratory- Manufacturing Technology Division (Mantech), and indirect customers (Lockheed-Martin, Boeing, the Army, and the Air Force) were involved in end-of-phase II briefings where preliminary plans for phase III were presented and discussed. Brainstorming sessions were held with the PT and MI teams to ensure that their Validation and Transfer issues were addressed. In these sessions, the input of the commercial partner, TRW AEN was also addressed. These reviews resulted in the establishment of a phase III plan for the BP team that focused on obtaining independent commercial input on the BP products, and updating those products to be more commercially acceptable.

There was concern whether the relationship between TRW ASD and TRW AEN represented a unique case because they were part of the same corporation. The contention was that the military unit, TRW ASD, would be able to influence TRW AEN to accommodate military-unique business practices that other non-affiliated commercial suppliers would resist. To overcome this concern it was decided to conduct an independent BP Validation by commercial firms. Specifically, the commercial firms were asked to validate potential cost avoidance and comment on the acceptability of the BP Manual and Model Subcontract.

The BP Validation task can be best described as an in-depth market research and source selection effort. The first step was to identify an industry segment that performs electronic printed wiring board assembly work similar to that performed by TRW AEN. The Electronic Manufacturing Services (EMS) industry is such a segment. The EMS industry consists of over 300 firms who offer design, assembly, and test services to companies worldwide. In 1997, this industry generated revenues of greater than $18 billion in the U.S. and $76 billion worldwide. Of this amount, only 1.1% ($198 million) were in support of military contracts. This percentage has been in decline for the past few years (e.g. 2.2% military revenues in 1996). The EMS industry was felt to be as “purely commercial” an industry as could be found that shared process technologies with TRW AEN.

Initially, thirty (30) suppliers were contacted for participation in the BP Validation. Only four (4) suppliers completed the validation tasks, the others were "just too busy". Additional suppliers were contacted to provide a "price only" quote with no review of the business practice requirements. In the end, 5 suppliers completed the evaluations of the Model Subcontract and BP Manual and 11 provided price quotes.

The BP Validation participants were asked to provide comments as to the acceptability of the business practice requirements and the model subcontract terms and conditions. In addition, a fixed-price quotation for the delivery of 75 PNP and 41 FEC modules in accordance with an attached set of drawings was requested. Finally, feedback from the participants on the producibility of the MPCL commercial design was requested. In discussions with each of the validation participants, TRW made it clear that there was no intention to award contracts based on participant responses or quoted prices. The BP IPT did offer to provide benchmark information of the price quotes received to each participant in a manner that shielded the identity of the other participants. TRW initially planned to pay for responses from two or three participants. However, in subsequent discussions with suppliers, each participant provided the requested information voluntarily, without any payment. The supplier deemed the pricing benchmark information as adequate compensation for the cost of quoting. The validation process continued after receipt of the data with a thorough analysis of the responses by the MPCL team.

To get a better sense of the commercial electronics suppliers' general understanding of the impact of recent acquisition reforms, and to gauge their willingness to bid on military business, the MPCL team conducted a broad-based survey of both the EMS and PWB industries. This was referred to as the Commercial Impact Survey. This research was designed to cover issues not addressed in two previous Coopers & Lybrand surveys focusing on commercialization barriers, as well as highlight areas where additional acquisition reforms may be necessary.

Disseminating MPCL products has been a prime objective since the beginning of the program. For this endeavor, the BP IPT was assisted by the ASC Acquisition Desk Book project. The Acquisition Desk Book is a web-based source of acquisition guidance and

lessons learned for Government and contractor personnel. The BP IPT has placed both the BP Manual and the Model Subcontract on the Desk Book web site. The BP IPT has also continuously presented MPCL findings to Government and industry audiences in forums such as the Defense Manufacturing Conference and the Industrial Base Pilot Industry Days. Dissemination activities also included direct meetings with suppliers such as Rockwell Collins. These meetings are designed to target specific programs for direct transfer of MPCL products and processes.

4.4 Phase III Accomplishments

Phase III focused on a validation of the BP Manual and a Commercial Impact Survey. A summary of accomplishments follows.

4.4.1 BP Requirements Validation

To validate the transferability of the military products from commercial lines concept, the team constructed a validation survey process that was modeled after a typical commercial transaction for EMS services. The team used Internet searches and industry trade journals to identify the major EMS industry firms. The MPCL team constructed a request for quotation package (RFQ) which included the business practices handbook requirements, the model contract terms and conditions, and a representative build and test quantity of IBP modules. A full technical data package was provided to each participant, although the team provided the same material pricing data to each firm to avoid needlessly exercising component suppliers. In addition to asking for pricing information, participants were also asked for qualitative feedback on the producibility of the commercial redesign and the commercial acceptability of the handbook and model contract.

Following the analysis of their responses, the MPCL team scheduled site visits with the validation participants. In these site visits, their written responses to the MPCL manual and contract requirements were discussed, plant tours were taken and general Q&A sessions were held. The plant tours and discussions with their management affirmed that each of these suppliers had the processes and procedures capable of meeting the MPCL requirements.

A cross-section of the EMS industry was included in the survey; from very small (<$30M / year sales) to very large (>$1B / year sales) firms. The firms identified as ovals in Figure 4-1 are the primary validation participants who provided quantitative and qualitative feedback, and accommodated a site visit. The other firms represented on the map either provided pricing information, or handbook and model contract feedback.

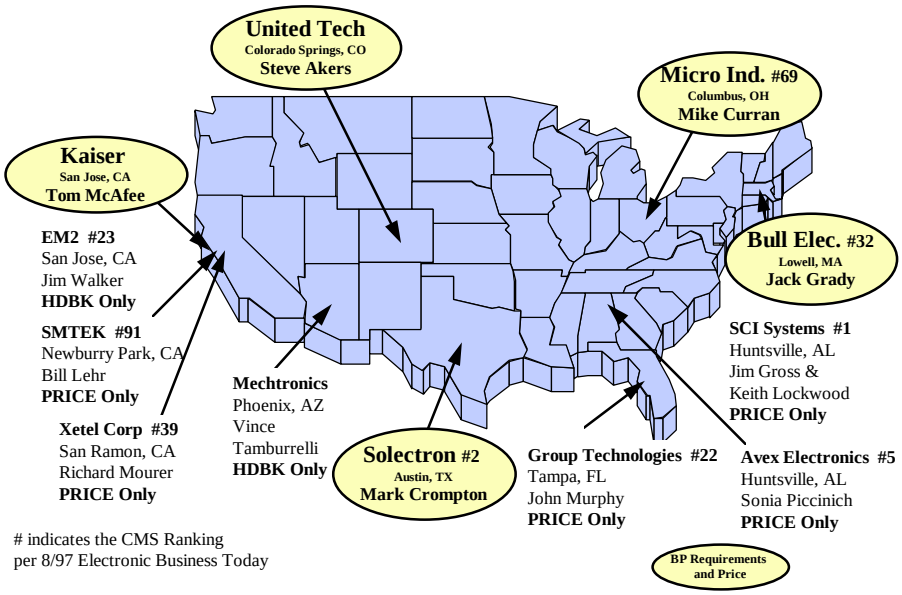


Figure 4-1. Requirements Validation Survey Participants

The results from the validation survey were important in that they suggested that many of the key aspects of the MPCL process are transferable to other commercial firms. Figure 4-2 shows how the participants rated the acceptability of the MPCL BP Manual. Of the total 76 requirements in the handbook, 53 (or 70%) were acceptable. Seventeen requirements (or 22%), while acceptable, would add cost. Only 6 requirements (8%)

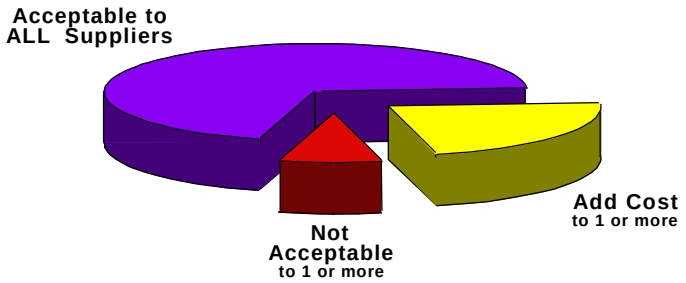


Figure 4-2. Handbook Requirements Validation Survey Results

were considered unacceptable to the validation participants. Comments from the participants were used to help modify those requirements that add cost or were unacceptable to make them commercially acceptable in a future revision to the BP Manual.

The 17 cost adding and six unacceptable requirements are shown in Table 1. Note the lack of consensus among the participants on these requirements. Notification of Product

Specific Requirements Determined To Be Cost-Adding By Participants

Requirement Description	No. of Firms
Operational Requirements Matrix	1
Program Control Plan	1
Customer Verification @ Manufacturing Readiness Review w/ FCA	1
Customer Verification @ Production Verification w/ PCA	2
Parts Control Program	1
Configuration Status Record	1
As-Built-Configuration Report	1
Functional Configuration Audit (see #12 above)	1
In-process Inspection Witnessed by Customer	1
Final Acceptance Insp Witnessed by Customer	1
Control of Non-Conforming Product	1
Customer-Owned Property (Tracking/Reporting)	1
Bar Code Symbology	1
Reporting of Manufacturing Process Controls	2
Control of Process Parameters & Key Characteristics	1
Reliability Program	2
Product Failure Reports	1

Specific Requirements Determined To Be Unacceptable By Participants

Requirement Description	No. of Firms
Notification of Product Phaseout or Process Change	1
Subcontractor Flowdown of Configuration Mgmt	3
Cost-of-Quality Demonstration or Reporting	3
DPAS Ratings on Purchase Orders	4
Customer Property Recording & Reporting	1
Reliability Program	1

Table 1. Requirements Survey Feedback - Unacceptable and Cost-Adding Requirements

Phaseout was a problem for one EMS firm, due mainly to the fact that it does not have a design capability. Their position was that the designer should know more about the product life than the manufacturer. This firm did indicate that it would perform this function for a customer with whom it had a strategic alliance. This was a common theme for many suppliers. They are just as particular about their customer bases as many customers are about their supplier bases. This situation suggests that the DoD may want to revisit its role as a customer in the commercial sector.

Three suppliers were opposed to flowing down requirements to subcontractors. They did not view this as a commercial practice. Cost of Quality reporting was also a problem for three firms. The process is deemed to be obsolete by these firms, and has been replaced by Statistical Process Control (SPC) and real-time process monitoring capabilities. The Defense Priorities and Allocation System (DPAS) was the requirement that garnered the most disapproval from the participants. EMS firms do not want government involvement in the prioritization and scheduling of their factories, as is required by DPAS. One firm also expressed concern regarding the reliability program requirement. This would obviously apply only to firms doing some design work; again, one of the participants has no design function.

Table 1 also provides the cost-adding requirements identified by the EMS suppliers. It is important to note that these firms are positioned to accommodate unique customer requirements. So, some would argue that they do not represent a good industry for testing the acceptability of a new set of replacements for military requirements. These concerns were discussed with each participant and the consensus feedback was that accommodation of requirements occurs in all industries, dependent upon the level of

customer commitment. Firms will do what you want, if you commit to a long-term relationship. Many of the MPCL requirements were acceptable to the participants if they came from a strategic customer. However, for a one-time customer, these requirements were identified as out of the norm, and therefore viewed as contributors to cost. The MPCL team did not endeavor to get participants to provide the level of cost added for each requirement. Universally, they agreed that this varies from customer to customer, again, depending on the nature of the relationship. Some of these may be done for some customers without additional cost. This suggests that military customers with fiscal-year funding constraints would have difficulty dealing with commercial suppliers from these industries. The lack of multi-year funding associated with most military programs is seen as a key barrier to commercial-military partnerships.

Of particular interest among the cost adding requirements are Customer Verification at Production Verification with Physical Configuration Audit, Customer Verification at Manufacturing Readiness Review with Functional Configuration Audit, In-process Inspection Witnessed By Customer, and Final Acceptance Inspection witnessed by Customer. Each of these requirements involves the customer in the supplier's production process. In general, the participants expect these, accommodate them, and only a small percentage of them charge customers extra for them. In other words, it is acceptable commercial practice to accommodate customer audits and inspections. The key distinction here is customer. The commercial world generally does not have the equivalent of the military's large customer structure. The type of audits and inspections are those done by the direct customer (not DCAA, not DCMC, and not prime contract representatives).

The real measure of the transferability and acceptability of the MPCL commercial redesign, and streamlined business practices is measured by the pricing data received from participants. Figure 4-3 shows a fairly tight distribution of pricing submitted by the validation participants. The average price represents a 68% savings over the military base line cost for the F-22 and RAH-66 versions of these modules. A standard deviation at less than 20% of the average price attests both to the competitive nature of this market and the transferability of the MPCL commercialization approach.

The MPCL validation survey demonstrated that several commercial suppliers could build the redesigned military hardware at a competitive price. This confirmed that the modules were producible. The team was initially concerned that the low volumes associated with military products would be a deterrent to many of these firms. There were a few very large firms who declined to participate because of the volume associated with a military product. However, most firms look at the level of customer commitment in total, not at just one individual business opportunity. Strategic alliances and partnerships are important in the EMS industry. This emphasis on partnerships in the commercial sector runs counter to the standard government practice of funding programs on a fiscal year basis. Commercial firms prefer to deal with customers who can commit to a long-term relationship.

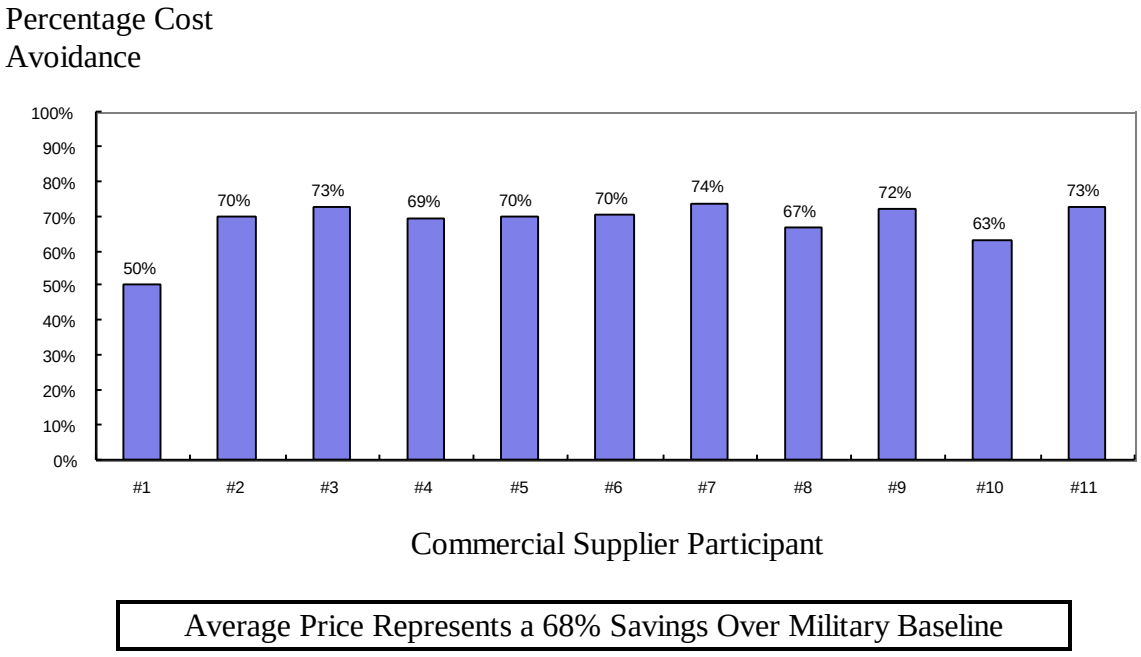


Figure 4-3. Requirements Validation Pricing Validates MPCL Savings Potential

Interestingly, the general feedback was that the commercial model contract was too favorable to the customer and was largely unacceptable to the suppliers. It is important to note that the MPCL team used typical commercial automotive industry terms and conditions. This indicates that there are also business practices in commercial contracts

that are not universally acceptable. These practices were revised based on the feedback of the validation participants to ensure a win-win contractual approach.

4.4.2 Commercial Impact Survey

Participating in the survey with TRW were the Institute for Interconnecting and Packaging Electronic Circuits (IPC) and the Massachusetts Institute of Technology (MIT). The IPC Director of Market Research provided access to the member and non-member mailing lists for both the EMS and PWB industries. The MIT Lean Aircraft Initiative (LAI) representative on the team received all the completed surveys and tabulated and analyzed results. The survey received an 11% (153/1340) response rate, which is good for a cold-survey like this, according to IPC, which frequently surveys its membership firms.

Prior IPC surveys show that the EMS industry (a $14B US industry in 1996) earned only 2% of its CY 1996 sales from government customers. The CIS agreed with that percentage. Because of data collection limitations, we couldn't conclude whether that number has changed appreciably in the time period since major acquisition reforms were enacted.

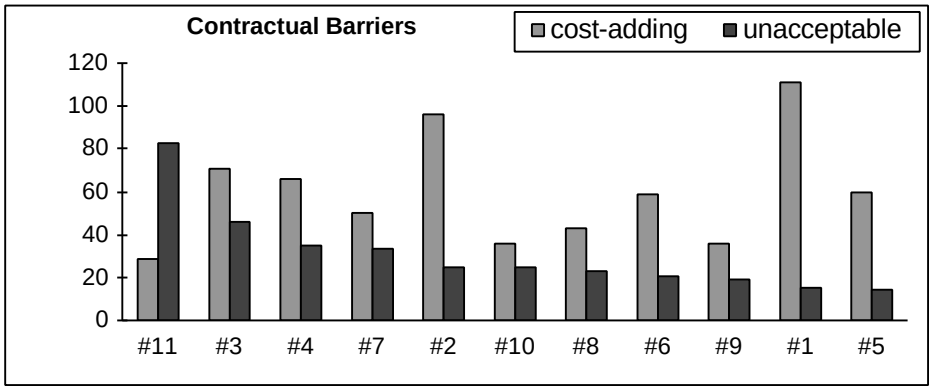
The survey also sought to answer the following questions.

- Are commercial suppliers aware of the significant changes made by the Government in acquisition reform? The Federal Acquisition Streamlining Act (FASA) and the Federal Acquisition Reform Act (FARA) hold great promise for increased sales to the government by commercial firms. Are suppliers aware of this?
- And further, if they are aware, are they interested in doing government work?
- Do they see the military as a potential strategic customer?
- What are the barriers that prevent more commercial involvement in military programs?

The survey participants indicated that the word is not getting out on acquisition reform. While the majority (65%), have heard about military specification and standard

cancellation, only 10% were aware of the contractual changes (FASA and FARA) that would seem to offer the best inducement for increased partnering between commercial suppliers and military customers.

Contractual barriers to commercial access were also addressed by the survey. A number of other studies have focused on the defense contractor's view on barriers to using commercial suppliers (see for instance, the TASC/Cooperís and Lybrand report, "The DoD Regulatory Cost Premium: A Quantitative Assessment", December 1994). In contrast, this survey addresses only commercial firms. The bar chart in Figure 4-4 ranks such contractual practice barriers as cost accounting standards, truth in negotiations, and unique reporting requirements. The chart shows the ranking of barriers that either add cost if complied with, or are unacceptable barriers to commercial access by military customers. The most significant observation in Figure 4-4 is that commercial suppliers adamantly oppose any restrictions on their profitability imposed by government contracting regulations. Other practices considered unacceptable by many of these commercial firms include the imposition of government cost accounting standards and the requirement for cost and pricing data. These, of course, all represent significant deviations from general practice in the commercial marketplace.

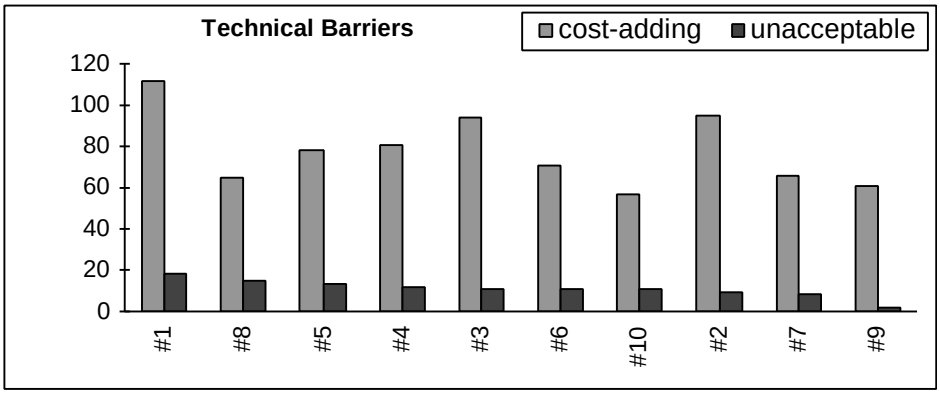


#1	Government unique specs and stds
#2	Government reporting requirements
#3	Government cost accounting standards
#4	Government audits of accounting, purchasing, etc.
#5	Contract terms and conditions
#6	Defense market volatility
#7	Cost and pricing data
#8	Data/intellectual property rights issues
#9	Restrictions to off-shore fabricators
#10	Socioeconomic provisions
#11	Profitability restrictions

Figure 4-4. Ranking of Contractual Barriers by Commercial Firms

The findings also indicate that many of the government's requirements eliminated by expansion of the commercial item definition (barriers such as CAS and TINA) are still perceived as barriers by commercial suppliers. As a result of FASA and FARA, commercial item suppliers should no longer be holding up CAS and TINA as barriers on commercial item contracts. This situation suggests there is an education problem. It can't be determined from this survey whether the problem lies with the commercial supplier who is not seeking this information, or with the military customer who is not implementing the changes brought about by FASA and FARA. But clearly, the ground- breaking changes that are in place due to FASA and FARA have not filtered down to the commercial suppliers who would seem to be among their primary beneficiaries.

The survey also asked the participants to rank technical barriers to doing military contract work (see Figure 4-5). Technical barriers include such items as special test, quality, and reliability requirements. One notes immediately that significantly fewer



#1	Special operational test rqmts
#2	Quality requirements/stds
#3	Reliability or qualification test results provided to customer
#4	Flow down of requirements to subs
#5	Physical configuration audits
#6	Functional configuration audits
#7	First article inspection
#8	In-process source inspection
#9	Small lot quantities
#10	Final acceptance customer source inspections

Figure 4-5. Ranking of Technical Barriers by Commercial Firms

suppliers consider technical barriers to be unacceptable when compared with the contractual barriers shown in Figure 4-4. Though this may seem like good news, it still reinforces the idea that while commercial suppliers are willing to contract for commercial work, the military customer will have to expect to pay higher prices for any unique specifications, regulations, or oversight that it chooses to impose. This suggests that some of the beneficial cost reductions the DoD had hoped to realize through using the commercial supplier base will not occur if the military customer itself doesn't fully embrace general commercial contracting and oversight practices. Those practices ranked most frequently as unacceptable by the survey respondents include special operational test requirements, in-process source inspection, and physical configuration audits.

The data in Figures 4-6 and 4-7 show that smaller firms, and firms specializing in low-volume, high-mix products are more likely to consider DoD sales vital than do larger firms. This suggests, perhaps, that military products don't provide enough revenue

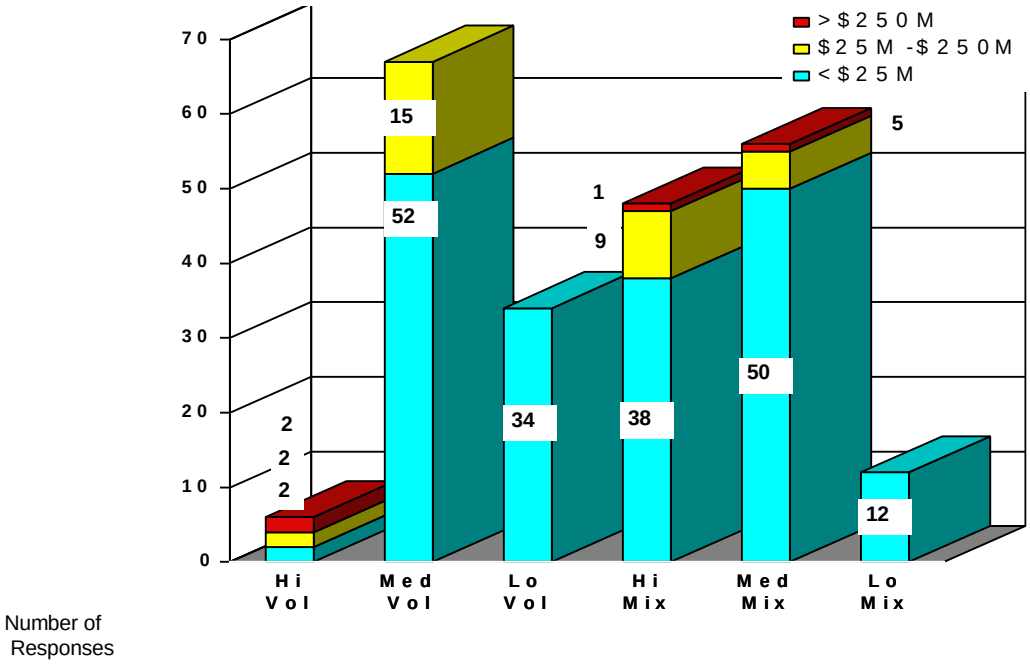


Figure 4-6. Commercial EMS and PWB Firm Sales Volume/Mix Data

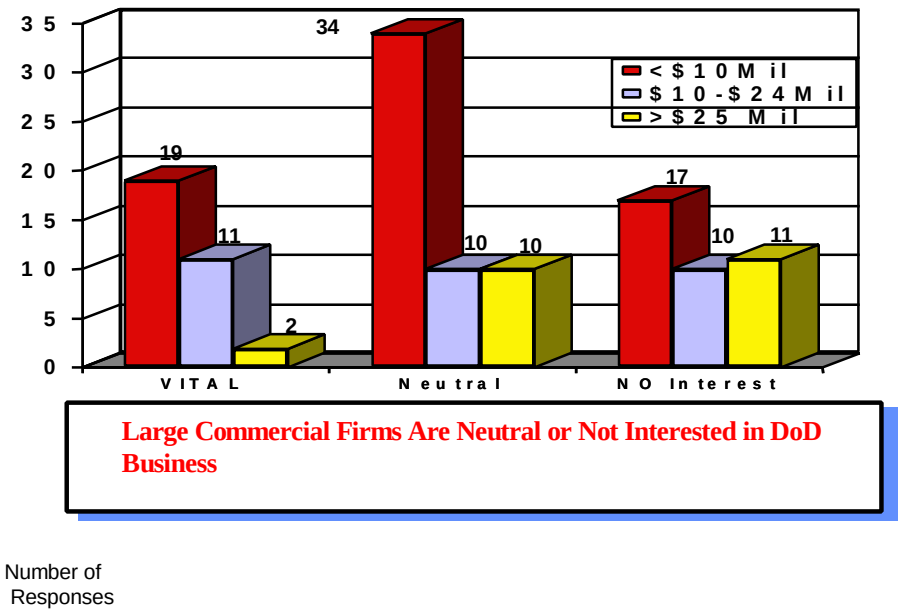


Figure 4-7. Interest in DoD Business by Firm Size

for large, high-volume firms with large capital asset structures. While this may preclude the firms with the greatest scale economies from producing defense products, it does indicate clearly where DoD contract solicitation and education efforts should be directed. Additionally, the firms most likely to see DoD sales as vital are producing products in low to medium volume, with a medium to high mix of products. This is important, in that

most DoD customers have a high mix of low volume products. So the good news is that there is a segment of the commercial market that is interested or potentially interested in DoD work, and can bring the DoD many of the advantages it is looking for in commercial items - specifically lower cost, quicker time to market and higher quality levels. The bad news is that commercial suppliers do not realize that significant changes have taken place which now make doing business with the DoD far more attractive.

The data showed that the biggest EMS and PWB firms were generally not interested in DoD work, while small firms showed the greater interest levels. It is important to note that among the many streamlining measures enacted by the US government, the area of small business preference was largely unchanged. So a good match would appear to be in place for military customers looking to "go commercial" and small commercial suppliers.

The MPCL team's experience with the requirements validation surveys conducted with EMS firms highlight the importance of customer-supplier partnerships. Commercial suppliers are much more likely to cater to those customers who can provide long term commitments. Military customers wishing to engage in such partnerships must find ways of overcoming the fiscal year funding constraints of military programs. EMS firms in the validation surveys also indicated that the military-unique MPCL modules are producible. This indicates that the use of commercial parts and practices by military customers is a key tool for gaining access to the commercial supplier base. The resulting prices bid by the EMS participants validated the significant cost savings potential of the military products from commercial lines concept.

The survey can be summarized with three key findings and one important message for military contractors. First, smaller commercial firms may be a better fit with military customers. They are better because they appear willing to do military work and can offer increased flexibility along with the cost savings desired by the military. They also offer the benefit of assisting the military customer's socioeconomic purchasing objectives. Second, the commercial supplier base still perceives barriers in place to doing military work. They feel that many of the contractual barriers are unacceptable and therefore deal-breakers, while technical barriers primarily just add cost. This is important for military buyers to

recognize as they increasingly attempt to access the commercial market. A final point to be made is that a mixed message on knowledge of acquisition reform was evident from the survey results. Apparently the word is out on knowledge of the cancellation of large numbers of military specifications and standards, due largely, we think, to the press coverage for former Defense Secretary Perry's initiative in 1994. However, the streamlining measures that stand to offer commercial suppliers the greatest access to military work (FASA and FARA) are largely unknown to these suppliers. Is this the military buyer's fault (failure to educate the supplier base, failure to implement FASA and FARA including market research, commercial item preference, etc.)? Or is it a failure of the supplier to learn more about their changing customer environment? A key lesson from this survey is that both DoD customers and suppliers can benefit from basic market research. The partnerships necessary for the future success of commercial item acquisitions by DoD customers depend on both parties understanding the new rules of the game.

4.4.3 Dissemination Activities

The MPCL team incorporated the feedback from the validation and survey tasks into the BP Manual and Model Subcontract. The validation and survey tasks addressed the acceptability of MPCL BPs to the commercial electronics sector. The other part of the equation is getting acceptance from military acquisition organizations and contractors. To accomplish this objective, the MPCL team worked closely with other groups pursuing related objectives. These groups included the Performance-Based Business Environment (PBBE) project group within the Aeronautical Systems Command (ASC) at Wright-Patterson AFB, OH and the Acquisition Deskbook project office within the Department of Defense. Meetings were held with the PBBE and Deskbook project teams to determine appropriate distribution and maintenance methods for the MPCL business practices. In order to provide broader usage of the MPCL concepts, both organizations agreed to host the BP Manual and the Model Subcontract on their internet homepages.

Final versions of the model subcontract terms and conditions and Business Practices Manual are available at the Acquisition Desk Book web site. In addition, the Model

Subcontract is attached as Appendix A. The BP Manual is not attached to this report due to its size, but is available under separate cover.

4.5 Phase III Summary

The validation and dissemination of MPCL business practices begun in Phase III is only the beginning of the institutionalization of the results of the MPCL project. Through communication of the results of MPCL and initial use of its products, many of the barriers due to lack of knowledge have been overcome. Continued education of both the commercial and military communities is required to make MPCL BPs standard practice.

Benefits of MPCL are obvious. Those prime contractors and major subcontractors that apply this process will achieve reduced costs and improved product development lead times. They will be the contractors and subcontractors who will be awarded the future defense contracts.

More has been done for acquisition reform and commercialization in the last three years than in the previous twenty. However, to declare completion of acquisition reform at this point would be premature, given the number of difficult issues that remain. Full implementation and acceptance of acquisition reform will take a very long time.

What acquisition reform has done is laid the groundwork for commercialization. Many barriers to more efficient procurement have been removed. Indeed, the conversion to reliance on industry standards from military standards is well underway and methods for contract streamlining are now more readily available. The next step, then, is to look at DoD as a customer and measure progress from a world class supplier's point of view.

Acquisition reform effectiveness, to date, has been measured using such DoD metrics as number of requirements eliminated. While reducing the number of pages of a proposal by 50 percent is significant from a DoD perspective, perhaps commercialization success should not be measured from a DoD perspective. Since the DoD is becoming a small customer, metrics are needed which measure the value of the DoD as a customer. For example, do DoD proposals reflect industry practices by using industry terms and conditions? Are world class commercial firms seeking defense work? Or are world class firms refusing DoD business, even when actively sought? What can the DoD do to attract

world class suppliers? What can the DoD do to become a valued customer? A preferred customer? Answers to these questions should be objectively analyzed and, if the facts warrant, should be used to help shape future DoD acquisition policy, practices, and regulations.

Since the DoD's market share is decreasing, its leverage to attract quality suppliers is diminishing, and the importance of emulating commercial practices is growing. The defense manufacturing facilities for which it makes sense to continue funding still have much to learn from commercial industry in terms of efficiency. The potential to merge traditionally separate military and commercial production lines which produce similar items still exists. To date, the DoD has merely scratched the surface in its approach to leveraging high quality, high volume commercial production facilities for the manufacture of low volume military products. In any of these cases, the DoD must continue its efforts to be commercial-like in its acquisition practices, especially to expand its industrial base to include purely commercial firms.

Recognizing and addressing the inherent differences that exist between the defense and commercial procurement systems is a significant move toward cultural change. Future acquisition reform efforts should establish a defense procurement system which meets military requirements while incorporating characteristics for commercialization. First, it should remain sensitive to the fiscal and ethical responsibilities inherent in government procurement. Second, it should facilitate the production of both commercial and military-unique products in a single business unit without altering either their accounting systems or management practices. Third, it should give proper consideration to the customary practices of commercial firms when developing acquisition strategies and contracting arrangements. This includes adopting industry standards to define requirements and adopting a design-for-manufacturability philosophy. Next, it should encourage a cultural change that focuses on risk management rather than on risk aversion. This will require management support at all levels and better training of the acquisition work force in market research, pricing and other commercial procurement practices. Finally, steps should be taken to build on the strong foundation that has been established and follow through with these goals for future reform.

Appendix A - MODEL SUBCONTRACT

Appendix B - BUSINESS PRACTICES MANUAL –

Only the summary of the document is included herein. The entire document is available under separate cover.

Appendix C – "Pricing: A Major Hurdle in Acquisition Reform"

Appendix D – MPCL Commercial Item Determination Lesson Learned

References

Appendix E - ARTICLE: Contract Management April 1998

- **Barriers and Opportunities with Using Commercial Suppliers**

Appendix A

Military Products from Commercial Lines

Model for a Commercial Item Subcontract

September 1998

Materials and Manufacturing Directorate
Air Force Research Laboratory
Air Force Materiel Command
Wright-Patterson Air Force Base, Ohio 45433-7739

Model for Commercial Item Subcontract

A significant portion of the Business Practices (BP) effort on the Industrial Base Pilot (IBP) program, "Military Products from Commercial Lines" (MPCL), involved defining a contract relationship based on a commercial contracting model. The potential benefits of this effort are twofold. The first benefit is that the new contracting model opens up a much broader military supplier base by inducing commercial suppliers to respond to solicitations for military products. The second benefit is that the contracting model can be applied to existing military contracts to make them less expensive to implement and administer. An MPCL Model for a Commercial Item Subcontract is a primary product of this work.

There is no one specific way to create a contract. Each contractual relationship is unique by its very nature. The BP integrated product team (IPT), therefore, took a "cafeteria style" approach to putting the model subcontract together. The parties to the contract can pick and choose the clauses that meet their specific requirements.

The MPCL Model for a Commercial Item Contract is derived from several sources, including the Federal Acquisition Regulation (FAR), a recommended commercial contract from the American Bar Association (ABA), and the subcontract between TRW ASD and TRW AEN for the production of the IBP modules. In addition, ten commercial suppliers reviewed a draft version of the model subcontract to determine its efficacy. Their comments have been incorporated into the final product.

The recommended Model for a Commercial Item Subcontract consists of three sections plus two exhibits as shown below.

- SECTION 1 - Subcontract
    - Parties to the Contract: names and locations of buyer and seller, contract acceptance.
    - Product Schedule: part numbers, supply or services descriptions, unit prices, quantity and delivery schedule, and special requirements such as tooling, acceptance criteria (if not stated in specifications), warranty period.

    - Order-unique Clauses: clauses that address the shipping location, supplier's past performance or the customer-supplier relationship, e.g., FOB point, inspection and acceptance or customer witnessing requirements, or special packaging or shipping instructions.
    - SECTION 2 - Terms and Conditions
    - SECTION 3 – FARS and DFARS Schedule
    - SECTION 4 – Exhibits
- Exhibit A - Performance Specification to include standards
- Exhibit B - Business Practices Manual
- Exhibit C – Statement of Work

The model subcontract should be used as the basis for negotiations. The terms and conditions have specific options that can be chosen. The terms and conditions have recommended language; however, the buyer and seller should review these clauses to arrive at appropriate modifications or deletion.

The model subcontract helps establish the legal relationship between the parties. The Business Practices Manual, Exhibit B, establishes the operational relationship. As with the terms and conditions of the model subcontract, the requirements of the Business Practices Manual should be negotiated between the buyer and the seller. The resultant mutually acceptable requirements become part of the final contract by incorporation.

Attachment: Model for Commercial Item Subcontract

Model for

COMMERCIAL ITEM SUBCONTRACT

Between

_____

as "Buyer"

and

_____

as "Seller"

Subcontract No.: TBD

Ref. Prime Contract No.: TBD

5 COMMERCIAL ITEM SUBCONTRACT

5.1 Parties to the Contract

This Firm-Fixed-Price Commercial Item Subcontract is made and effective as of the __ day of __,199_ (the "Effective Date") between
BUYER NAME ___ ("Buyer"), located at __(ADDRESS, CITY, STATE, ZIP)__ and
SELLER NAME __ ("Seller"), located at _(ADDRESS, CITY, STATE, ZIP)

5.2 Products and Services Delivery Schedule.

Seller shall provide the Products and the Services, and any personnel, material, equipment and facilities, necessary to perform the Work and comply with the delivery dates, set forth below, subject to the terms and conditions of purchase (Section 1.3 and 2).

Item Description	Part Number	Quantity	Unit Price	Delivery Date
(1)				
(2)				

5.3 Order Unique Clauses

5.3.1 FOB Point

Insert unique clause language.

5.3.2 Inspection and Customer Witnessing Requirements

Insert unique clause language.

5.3.3 Special Packaging and Shipping Instructions

Insert unique clause language.

1. TERMS AND CONDITION OF PURCHASE

1.1 Definitions

[ ] (FAR 52.212-4(e)) The clause at FAR 52.020-1 DEFINITIONS, is incorporated herein by reference.

1.1.1 Buyer

- "Buyer" means (company name & location); the party issuing the contract.

1.1.2 Authorized Representative

- " Authorized Representative" means any person(s) authorized by Buyer to alter, modify or change the provisions of the order or otherwise direct or redirect the Seller's efforts with respect to this order. The authorized representative is identified in Clause 2.2.1, AUTHORIZED REPRESENTATIVE, below.

1.1.3 Seller

- "Seller" means (company name & location); the party performing to the contract.

1.1.4 Signature

- Signatures include manual signature or electronic signature (email date with date/time stamp, showing sender name).

1.1.5 Free on Board (F.O.B.)

- Without charge for delivery to and placing on board a carrier at a specified point.

1.2 Change Notification

- [ ] All notices must be in writing and transmitted via [ ] Registered mail, [ ] FAX, [ ] electronic mail or [ ] hand carried to the authorized representative of the other party set forth in Clause 2.2.1.

1.2.1 Authorized Representative

Customer: _____ Seller: _____
Address: _____ Address_____

Attention: _____Attention:_____
Tel:_____ Fax: _____Tel:_____ Fax:_____

1.3 Acceptance of Order

Seller will be deemed to have accepted this order when Seller:

- [ ] Acknowledges this order
- [ ] Begins performance under this order
- [ ] Notification to Buyer of commencement of performance
- [ ] Accepts any form of payments
- [ ] Acceptance should occur within ____ days.

General Provisions:

- [ ]Acceptance is limited to the Terms and Conditions stated herein or incorporated by reference. Except as otherwise provided herein in clause 2.13. Any changes by either party must be agreed to in writing.

- [ ] Buyer's Terms Prevail
  Additional or differing terms and conditions proposed by the Seller shall be void and have no effect unless accepted in writing by the Buyer.

- [ ] Buyer and Seller agree that, notwithstanding the prior or subsequent use by Seller of any order form, invoice or other document containing printed terms or conditions, they are contracting solely' on the basis of this order, which contains the **entire understanding** of the parties and is intended as a final expression of their agreement and a complete statement of the terms thereof, and may not be amended, modified or otherwise supplemented unless such amendments, modifications or supplements are in writing and signed by Buyer's authorized representative.

1.4 Variation of Quantity or Delivery Schedules

- [ ] Product quantity and delivery according to schedule is a material condition of this order.

1.4.1 Seller responsibility:

- [ ] Seller shall notify the buyer as soon as possible when it is known that any scheduled delivery will not be met.
- [ ] Buyer may return at Seller's expense, any product delivered after the delivery date or in excess of the specified quantity.

1.4.2 Buyer responsibility:

- [ ] The Buyer will be responsible for carrying charges at the rate of __% per month of the value of material held at the Seller for costs incurred to accommodate any extension of production schedules greater than 30 days.
- [ ] If buyer fails to take delivery of the quantity of items upon which a quantity discount price is based, the Buyer will be back-billed based upon the actual quantity delivered as determined by the pricing schedule in effect at the time of the original order.
- ALTERNATE: [ ] The Buyer is responsible for costs resulting from expedited or delayed delivery schedules, and reduction of quantity or failure to accept shipment of the entire quantity ordered which may result in pricing at previously quoted lower quantities.

1.5 Payment

- Payment shall be made for items accepted by the Buyer that have been delivered to the delivery destination set forth in the contract.
- [ ] (FAR 52.212-4 (i)) Electronic Funds transfer Payments – The Buyer (Government) shall make payment in accordance with FAR 52.232-33 Mandatory Information for Electronic Funds Transfer Payment.

1.5.1 Invoice

- [ ] (FAR 52.21204 (g)) The contractor shall submit an original invoice and __ copies (or electronic invoice, if authorized) to the address designated in the contract to receive invoices. Invoices must include adequate information to identify the order, products shipped, and shipment method and date.

1.5.2 Terms of Payment

- [ ] (FAR 52.212-4(g)) Invoices will be handled in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget Circular A-125, Prompt Payment.
- [ ] Buyer is allowed a prompt pay discount = ___% for payment of invoice within specified period.
- [ ] (FAR 52.212-4(i)) In connection with any discount offered for early payment, time shall be computed from the date of the invoice.
- Buyer shall pay the Seller the price due:
  - [ ] within ___(10, 30, 45, 60, other) days
  - [ ] after receipt of correct invoice
  - [ ] after receipt and acceptance of product
  - [ ] in currency of [ ] U.S. dollars [ ]

1.5.3 Taxes, Duties, Fees

- [ ] The Seller shall be responsible for all applicable federal, state and local taxes, duties, value-added taxes, tariffs and similar fees imposed by any government or regulatory charges of any country. These costs are included in the total order pricing.
- [ ] The Buyer shall be responsible for all applicable federal, state and local taxes, duties, value-added taxes, tariffs and similar fees imposed by any government, or regulatory charges of any country.
- [ ] The buyer shall obtain all licenses and consents for resale or export of products under the laws and regulations of any country.
- [ ] (FAR 52.2122-4 (k)) Taxes. The contract price includes all applicable Federal, State, and local taxes and duties.

1.5.4 Set Off / Offset

- [ ] Without any setoff or deductions
- [ ] Buyer shall have the right of setoff against payments due under this order or for any counterclaim arising from this or other orders between Buyer and Seller.

1.6 F.O.B

- [ ] Prices are F.O.B. Destination (buyer's specifies point of delivery) or
- [ ] Prices are F.O.B. Origin or shipping point (usually the Seller's plant)
- [ ] Seller's liability, title and risk of loss or damage will pass from Seller to buyer upon delivery to buyer-designated carrier at the F.O.B. point.

- [ ] Buyer's liability, title and risk of loss or damage for all Buyer furnished material, tooling or other property shall pass to the Seller upon identification, receipt and inspection at the Seller's plant.
- [ ] (FAR 52.212-4 (j)) Risk of Loss. Unless the contract specifically provides otherwise, risk of loss or damage to the supplies provided under this contract shall remain with the contractor until, and shall pass to the Buyer upon:
  - [ ] Delivery of the supplies to a carrier, if transportation is f.o.b. origin; or
  - [ ] Delivery of the supplies to the Buyer at the destination specified in the contract, if transportation is f.o.b. destination.
- [ ] (FAR 52.212-4-4 (n)) Title. Unless the contract specifically provides otherwise, title to items furnished under this contract shall pass to the Buyer upon acceptance, regardless of when or where the Buyer takes physical possession.

1.7 Product Warranty

SELLER WARRANTS TO THE BUYER THAT

- [ ] for a period of ____ (days/months/years, other) (3, 6, 12 mos.) from:
  - [ ] date of manufacture
  - [ ] date of shipment
  - [ ] Buyer's acceptance of items delivered under this order
  - [ ] acceptance by the Buyer's customer
  - [ ] if a product is installed on a higher level customer's product at the time of original delivery, the warranty period will be ____ (days/months/years, other) from the date of installation
- [ ] Products shall:
  - [ ] conform to all requirements of this order and applicable specifications
  - [ ] conform to all design and manufacturing requirements
  - [ ] be of merchantability quality
  - [ ] be free from all defects in Seller supplied material and faulty workmanship
- [ ] Products shall be fit and sufficient for their intended purposes (if Seller has or should know the buyer's intended purpose for the use of the goods.
- [ ] (FAR 52.212-4 (o)) Warranty. The contractor warrants and implies that the items delivered hereunder are merchantable and fit for the use for the particular purpose described in this contract.
- [ ] Customer supplied material shall be properly installed
- [ ] All warranties will run to Buyer and its customer. Buyer's customer or users may not ship warranty returns directly to the Seller. Buyer must obtain Return Material authorization prior to returning products.
- [ ] Provisos:
  - [ ] that the buyer notifies the Seller within ____ days after discovery of defect.
  - [ ] that defective product is returned to Seller within ___ year(s) after original delivery
  - [ ] that a Return Material authorization(RMA) is obtained from Seller prior to returning product.

1.7.1 Warranty Remedy

Seller's obligation for nonconforming product is limited, at Seller's option, to:

- [ ] repair
- [ ] replacement
- [ ] issue credit
- [ ] refund the price paid

1.7.2 Waiver of Consequential Damages

- [ ] Seller shall not be liable for loss or injury to third parties, or for special, incidental or consequential damages.
- [ ] Under no circumstances will the Seller have any liability, whether in contract or for negligence or otherwise and whether related to any single event or series of connected events, for any of the following:
  a) [ ] any liability in excess of
     - in the case of damage or loss of tangible property, the value of such property and
     - in any event, and in respect of any other liability,
       - [ ] the total of the contract prices paid by the buyer or
       - [ ] $____, whichever is greater

  b) [ ] any liability for incidental, indirect or consequential damages or loss of business, records or data, use, profits, revenue or anticipated savings or other economic loss whether or not the Seller was informed or was aware of the possibility of loss
  c) [ ] any third party claims against the Buyer for any loss, damage, cost or expense
  d) [ ] (FAR 52.212-4 (p)) Limitation of Liability. Except as otherwise provided by an express or implied warranty, the contractor will not be liable to the Buyer for consequential damages resulting from any defect or deficiencies in accepted items.

1.7.3 DISCLAIMER OF IMPLIED WARRANTY

[ ] This warranty is in lieu of all other warranties, express or implied, including but not limited to, the implied warranty of merchantability and fitness for a particular purpose.

1.8 Infringement Indemnification

- [ ] Seller will indemnify and hold harmless Buyer, its officers, employees, agents, successors, assigns, customers and users of its products from and against any and all losses, expenses, damages, claims, suits and liabilities (including court costs and attorneys fees) arising as a result of any claim that the manufacture, use, sale or resale of any Goods infringes any patent, utility model, industrial design, copyright, or other intellectual property right.
- [ ] Seller will, when requested by Buyer, defend any action or claim of such infringement at its own expense. Seller's obligations will apply even though Buyer furnishes all or any portion of the design of or specifies all or any portion of the processing for the Goods.
- [ ] If the sale and/or use of the Goods is enjoined or, in Buyer's sole judgment, is likely to be enjoined, Seller will at Buyer's election and Seller's sole expense, either procure

for Buyer the right to continue using such Goods, or replace same with equivalent noninfringing Goods, or modify such Goods so they become noninfringing, or remove same and refund the purchase price, including transportation, installation, removal and other charges incidental thereto.

1.9 Force Majeure

- [ ] (FAR 52.212-4 (f)) Excusable delays. The Seller shall be liable for default unless nonperformance is caused by an occurrence beyond the reasonable control of the Seller and without its fault or negligence such as, acts of God or the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, unusually severe weather, and delays of common carriers.
- [ ] (FAR 52.212-3 (f)) The Seller shall notify the Buyer in writing as soon as it is reasonably possible after the commencement of any excusable delay, setting forth the full particulars in connection therewith, shall remedy such occurrence with all reasonable dispatch, and shall promptly give written notice to the customer of the cessation of such occurrence.

1.10 Contract Termination

1.10.1 For Buyer Convenience

- [ ] Mutual right to cancel for cause

- [ ] Buyer may terminate this order or any part of it for its convenience by written notice to Seller. Upon receipt of notice of termination, Seller will immediately stop all work hereunder and cause any of its suppliers or subcontractors to cease such work. Buyer will pay Seller for all Goods which are (i) ready for shipment in accordance with this order's delivery schedule prior to Seller's receipt of the termination notice, (ii) conform to all requirements of this order, and (iii) are free and clear of all encumbrances.
- [ ] In addition to the above, Buyer liable for Goods in process of being manufactured and Material procured.
- Notwithstanding the foregoing, in the event that this order relates to Buyer's purchase of equipment (as that term is defined under Article 9 of the Uniform Commercial Code), Buyer's obligation to pay Seller will be limited to:
  - the lesser of: (i) Seller's actual cost for direct labor and other expenses directly and reasonably incurred pursuant to this order prior to receipt of notice of termination or (ii) the percentage of the original purchase price as the work done by Seller prior to receipt of notice of termination bears to the entire work covered by this order;
  - less any previous payments.
- [ ] In no event will Buyer be liable for amounts in respect of anticipated profits, lost profits, interest expense or other consequential damages. Buyer will not pay for any

work done after Seller's receipt of notice of termination, nor for any costs incurred by Seller's suppliers or subcontractors.

1.10.2 For Cause

- [ ] Termination for cause. The Buyer may terminate this contract, or any part hereof, for cause in the event of:
  - [ ] any default by the Seller, or
  - [ ] if the Seller fails to comply with any contract terms and conditions, or
  - [ ] fails to provide the Buyer, upon request, with adequate assurances of future performance.
- [ ] In the event of termination for cause, the Buyer shall not be liable to the Seller for any amount for supplies or services not accepted, and the Seller shall be liable to the Buyer for any and all rights and remedies provided by law.
- [ ] If it is determined that the Buyer improperly terminated this contract for cause, such termination shall be deemed a termination for convenience.
  - [ ] Seller shall have the right to cure the default if agreed to by Buyer. Cure period to be ____days.
  - [ ] Seller shall have the right to petition termination of contract for Cause.

1.11 Buyer Furnished Property

1.11.1 Buyer Retains Title

- [ ] Buyer will retain title to any property Buyer furnishes to Seller. Seller will not alter or use such property for any purpose other than that specified by Buyer or for any other person without the prior written consent of Buyer. Seller will keep adequate records of such property, which records will be made available to Buyer upon request, and will store, protect, preserve, repair and maintain such property in accordance with sound industrial practice, all at Seller's expense.

1.11.2 Handling, Tracking and Maintenance

- [ ] If Buyer’s property becomes lost or damaged while in Seller's possession, Seller will indemnify Buyer or replace such property at Seller's expense, in accordance with Buyer’s request. At the completion, cancellation or termination of this order for which Buyer’s property was required, Seller will request disposition instructions for all such property, or the remainder thereof whether in its original form or in semi processed form. Seller will make such property available to Buyer at Buyer’s request, in the manner directed by Buyer, including preparation, packaging and shipping as directed. Expenses for preparation for shipment will be for Seller's account and shipment will be made F.O.B. Seller's plant.

1.12 Disputes and Remedies

- [ ] The rights and remedies provided Buyer herein will be cumulative and in addition to any other remedies provided by law or equity. Buyer’s waiver of a breach of any provision hereof will not constitute a waiver of any other breach.

- [ ] The parties agree that neither party will be liable to the other for special, consequential or incidental damages and the maximum liability of either party to the other, whether arising in contract, tort or otherwise, shall not exceed the purchase price of this order.
- [ ] This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S. C. 601-613). Failure of the parties to this contract to reach agreement on any request for equitable adjustment, claim, appeal or action arising under or relating to this contract shall be a dispute to be resolved in accordance with the clause at FAR 52.233-1 DISPUTES, which is incorporated herein by reference. The contractor shall proceed diligently with performance of this contract, pending final resolution of any dispute arising under the contract.

1.13 Changes

- [ ] Buyer may at any time by a written order, as mutually agreed by Seller, but without notice to sureties change drawings, designs, specifications, materials, packing, time and place of delivery or method of transportation. If any such change increases or decreases the cost or time required for Seller's performance hereunder, an equitable adjustment will be made and this order will be modified in writing accordingly. Any claim by Seller for any adjustment hereunder must be made within thirty (30) working days of the date Seller is first notified of the change. If Seller's claim includes any cost for property made obsolete as a result of the change, the claim must be supported by releases (or other forms of authorization) provided by Buyer authorizing Seller to procure or manufacture the property, and Buyer may prescribe the manner in which such property will be disposed. Pending the resolution of any dispute regarding any such adjustment, Seller will diligently pursue the order as changed. No change to design, material, process, procedures or practice is to be made by Seller without written authorization by Buyer. Buyer will have the right to verify all claims hereunder by auditing relevant records, facilities, work or materials of Seller.

1.14 Proprietary Information --Confidentiality -- Advertising

- [ ] Each party will consider all information furnished by the other party hereunder (including drawings, specifications. or other documents prepared in connection with this order) to be confidential and will not disclose any such information to any other person, or use such information itself for any purpose other than performing this order, unless prior written permission is obtained.

- [ ] Neither party to the subcontract will advertise or publish the fact that a contract to purchase Goods has been let, or disclose any information relating to the order without the other parties written permission.

1.15 License to Repair; Use of Copyrighted Materials

- [ ] Seller hereby grants to Buyer a nonexclusive, royalty-free, irrevocable, worldwide license to repair, rebuild, reconstruct and relocate the Goods.
- [ ] Seller also grants to Buyer a nonexclusive, paid-up, irrevocable, worldwide license to use all copyrighted materials of Seller which are furnished to Buyer during the

course of Seller's performance hereunder and which relate to any Goods. Without limiting the generality of the foregoing, Buyer's use of such copyrighted materials pursuant to such license may include reproduction, distribution to customers and others and public display.

1.16 Tooling

- [ ] Unless otherwise specified in this order, all tooling and/or all other articles required for the performance hereof will be furnished by Seller, who will maintain such articles in good condition and replace them when necessary at Seller's expense.

- [ ] Tooling purchased by Buyer under this order shall be the property of Buyer and shall be marked and tagged by Seller as such. Seller shall bear all risk of loss and damage to Buyer's tooling and shall maintain such tooling at Seller's expense to the extent necessary to produce acceptable parts. Such repaired or replaced tooling shall also be the property of Buyer.

- [ ] Buyer's tooling shall not be (i) commingled with Seller's property or that of a third person (ii) used except for the manufacture of parts for Buyer or (iii) moved from Seller's premises without prior authority from Buyer. Buyer shall have the right to enter onto Seller's premises at all reasonable times to inspect Buyer's tooling and Seller's records pertaining to such tooling

- [ ] Under mutual agreement, Seller shall deliver Buyer's tooling to Buyer at location designated by Buyer. Buyer will reimburse Seller for any packaging and transportation costs incurred by Seller in delivering the tooling.

1.17 Severability

- [ ] Any provision of this order which is finally determined to be unlawful will be deemed severed from this order and every other lawful provision of this order will remain in full force and effect.

1.18 Assignments and Subcontracting

- [ ] This order may be assigned or subcontracted with the mutual consent of the Buyer and Seller. If Seller is authorized to use subcontractors, Seller will obtain from each such subcontractor rights and obligations no less favorable to Buyer than the provisions of this order.

1.19 Fair Labor Standards

Seller warrants that the Goods will be made in compliance with the Fair Labor Standards Act of 1938, as amended.

1.20 Governing Law

This order will be governed by the laws of the state shown in Buyer's address on the face of this order, and the Convention on Contracts for the International Sale of Goods shall not apply. The parties hereby stipulate irrevocably that they hereby submit to the personal

Jurisdiction of the courts of the above-referenced state and for purposes hereby waive all challenges to the personal jurisdiction of such courts.

1.21 Quality

1.21.1 Quality System

- [ ] Seller will maintain an inspection and quality system acceptable to Buyer and in conformity with any drawings, specifications and data which are part of this order and with the quality program described in materials referenced in Exhibit B – Business Practices Manual.

1.21.2 Document Retention

- [ ] Seller will retain such records for a period of [ ] 2 [ ] 3 [ ] 5 [ ] 10 years after of this order or as otherwise specified by Buyer, and make such records available to Buyer upon request.

1.22 Inspection and Acceptance of Goods

- [ ] All Goods are subject to final inspection and acceptance for 15 days after delivery to Buyer.
- [ ] Notwithstanding any acts of Buyer which may be deemed under applicable law to constitute acceptance of the Goods, payment for delivered Goods will not constitute acceptance thereof. Buyer may reject any Goods which do not meet the specifications set forth in this order. Buyer may return any such Goods to Seller for reimbursement, credit, replacement or correction as Buyer may direct, or Buyer may correct and/or replace such Goods at Seller's cost. Any Goods rejected by Buyer will be at Seller's risk and expense and Seller will not thereafter tender such Goods for acceptance unless the former rejection or requirement of correction is disclosed. Seller will reimburse Buyer for any packaging, handling and transportation costs Buyer incurs with respect to rejected Goods.
- [ ] Buyer may revoke its acceptance of Goods at any time, whether or not a substantial modification to the Goods has been made, if a defect in the Goods which could not have been discovered during Buyer's normal inspection procedures or which is not normally discoverable until the Goods are used substantially impairs the value of the Goods to Buyer.
- [ ] Neither Buyer's exercise of nor its failure to exercise, any rights provided hereunder will relieve the Seller from responsibility for such Goods as are not in accordance with the order requirements or impose liability on Buyer therefor.

1.23 Business Practices

- [ ] The processes necessary to develop and/or deliver the product defined in Exhibit A, Performance Specification, are defined in Exhibit B, Business Practices Manual.
- [ ] Buyer and Seller shall mutually agree to the processes described in Exhibit B which are applicable to this subcontract.

2. FAR AND DEFAR SCHEDULE

The following FAR clauses are requirements of this contract:

- [ ] FAR 52.222-26, Equal Opportunity (Executive Order 11246).
- [ ] FAR 52.222-35, Affirmative Action for Special Disabled and Vietnam Era Veterans (38 U.S.C. 4212(a)).
- [ ] FAR 52.222-36, Affirmative Action for Handicapped Workers (29 U.S.C. 793).

6 Exhibits

Exhibits A and B are incorporated by reference.

EXHIBIT A. PERFORMANCE SPECIFICATIONS FOR THE PRODUCT (ATTACHED)

EXHIBIT B. BUSINESS PRACTICES MANUAL (Attached or available at the following website: http://www.TBD)

EXHIBIT C. STATEMENT OF WORK

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the effective date.

"BUYER"
Buyer Company Name

By:_____

Print Name: _____

Title: _____

"SELLER"
Seller Company Name

By:_____

Print Name: _____

Title: _____

Appendix B

Business Practices Manual

Note: Only the Introduction is included herein. The remainder of the document is available under separate cover

Introduction

The Business Practices (BP) Manual is a mechanism to enable a business relationship between a military contractor and a commercial vendor. This document serves to replace military standards and military specifications with requirements based on commercial standards (ISO 9001, QS-9000, etc.) The requirements in this manual define the standards for acceptable supplier practices.

The intent of the BP Manual is to provide the Government or military contractor with sufficient information and guidance to tailor requirements that are mutually acceptable to themselves and commercial suppliers. Developing mutually acceptable requirements is vital in the procurement of a military product from a commercial supplier. With the elimination of military standards and the existence of a wide variety of national standards and competitive industry practices, the BP Manual serves to meet the following objectives.

- Assist the defense industry customer in obtaining a consistent evaluation of supplierís management and process capabilities.
- Convey the defense industry customer's business system requirements to suppliers.
- Assist the supplier in understanding the customer's expectations of the supplier's business systems.
- Identify business system requirements that should be specified in the contract or statement of objectives.

Practices that meet existing standards of the American National Standards Institute (ANSI), International Organization for Standardization (ISO), American Society for Quality Control (ASQC), Society of Automotive Engineers (SAE), Electronic Industry Association (EIA) or the supplierís own competitive commercial best practices may be used to satisfy the intent of the BP Manual requirements. The supplier, however, must have documented processes and procedures and be able to demonstrate compliance with the BP Manual requirements.

The BP Manual establishes a cafeteria-style menu for developing business practice requirements that can be incorporated as part of a contract. Requirements should be kept to the minimum and be tailored based upon the specifics of the product. The supplier may submit alternative approaches, but they must meet the intent of the customer requirements. To work best, requirements should be established in a cross-functional team environment and must be mutually agreed upon by the customer and the supplier.

In addition to the requirements are guidance statements that specify recommended processes. These recommended process statements are not mandatory to the supplier. A recommended process is looked upon as a best practice by the customer and would be evaluated positively during supplier selection if the supplier can demonstrate compliance.

The BP Manual is part of a new process for the procurement of military products from commercial sources. Taken together with the Model Subcontract, the BP Manual provides

a framework for the acquisition of commercial items. The following discussion places the BP Manual in the context of the overall DOD Acquisition Reform initiatives.

Acquisition Reform initiatives within the Department of Defense provide a mechanism for procuring military products from commercial suppliers. The key development is the use of a new commercial item definition per FAR 2.101 Definitions and Part 12: Acquisition of Commercial Items. Under this definition, commercial items or ancillary services are defined as:

(a) Any item that is of a type customarily used for nongovernmental purposes and that is offered and sold competitively to the general public. Commercial items usually have a catalog or published price sheet, are contracted on a firm fixed-price basis and are sold with a product warranty.
(b) Any item that evolved from paragraph (a) through advances in technology or performance, which will be available in the commercial marketplace.
(c) Any item in (a) or (b) but for: (1) modifications customarily available in the commercial marketplace or (2) minor modifications to meet the Government requirement. Minor modifications do not significantly alter the commercial function or essential physical characteristic, or change the purpose of a process. Minor may be determined by the modification value, size or scope relative to final product.
(d) Any combination of (a, b, c, e) that are customarily combined and sold in combination to the general public.
(e) Installation, maintenance, repair or training services if such services (1) offered to the general public and the Government contemporaneously and under similar terms and conditions. (2) offers to use the same workforce that is used for providing such services to the general public.

FAR Part 12 describes the policy the procuring Agency shall use to make a commercial item determination. *If the commercial item determination concludes that the item under consideration does not meet the definition of a commercial item, the IBP process can not be used. Factors that must be considered include:*

- ability of the product to meet the requirements
- price reasonableness or cost analysis
- quality of the product,
- suppliers' past performance.

The Commercial Item determination begins with market research to identify: 1) potential commercial products or services, 2) the quality of these products or services and 3) the level of competition or price reasonableness that exists in the commercial marketplace. The customer must ensure that commercial products meet their requirements for reliability, operational performance and logistics support. Commercial product information, performance data and test data should be used to substantiate market research.

Price reasonableness may be established by comparison to the same or similar items that are commercially available. The supplier may submit information to support commercial pricing, i.e. catalogs or published prices, and their rationale for pricing of modifications.

Contracts for commercial items shall rely on the contractorís existing quality systems as a substitute for Government in-process inspection and testing before the product is tendered for acceptance unless customary market practices include in-process inspection. This manual will be used initially to evaluate the quality system. Specific quality requirements for the procurement will be developed as part of the solicitation process and through negotiations.

Once the item is determined be a commercial item, a solicitation package can be issued to prospective suppliers. The solicitation package should consist of the MPCL Model Contract that includes attached exhibits: a technical data package to include a Performance Specification, the BP Handbook and a Statement of Work. The terms and conditions of the MPCL Model Contract are based on commercial practices and include only three FAR-based clauses:

- Equal Opportunity
- Affirmative Action for Special Disabled and Vietnam era Veterans
- Affirmative Action for Handicapped Workers

The responses to the solicitation package should be used to further qualify the suppliers, serve as a baseline for the eventual contract and establish price reasonableness. The supplier will review the solicitation package from both a contractual and a technical perspective. The technical perspective includes the SOW, performance specification and the BP Manual. The review of the BP Manual includes definitization of the requirements. The supplier review requires a self-assessment of their internal practices using the Operational Requirements Matrix form as a guide. The review may indicate that all operational requirements are adequately addressed, in the supplierís opinion, by their existing facility-wide processes. In this case, a properly signed certification in the suppliers' format is prepared indicating that no further documentation is necessary. If their existing processes do not satisfy all of the requirements, a Program Control Plan must be developed to define what must be changed to address the shortfall.

The supplier will also prepare a Commercial Item Price Evaluation to provide information for evaluating the reasonableness of price. The following topics should be addressed in this position paper:

- Data on sales of the commercial items to the general public.
- Product or process modifications that are customarily available for the commercial product as compared to modifications required for the Government product.
- Specific product and manufacturing process modifications required to meet the Government performance specifications.

- Comparison of the components required for the military product versus those commonly used in their existing commercial products.

Upon receipt of the supplierís proposal, the customer will evaluate the response, select a source and begin negotiations leading to a Commercial Item Subcontract.

BP Manual Section Summary

MANAGEMENT

Planning for Excellence during a product's life cycle includes requirements definition, design, development & verification, manufacturing, operations and support. These affect all functional groups within an organization and should therefore be developed by the cross-functional teams. Cross-functional teams identify problems early and maintain a cooperative spirit of resolution thereby providing the highest opportunity for program success. Attachment A contains the cafeteria-style Operational Requirements Matrix with recommended requirements for supplier proprietary items, build to print with existing suppliers, build to print with new suppliers and suppliers with design only responsibility. Attachment B contains the Operational Requirements Matrix used for the Industrial Base Pilot requirements and the supplier's Program Control Plan to meet customer requirements that are not addressed by their existing procedures and systems.

DESIGN ENGINEERING

A good design is required to satisfy the customer's performance, price and quality objectives as well as the supplierís profit objectives. The requirements in this section address the process for customerís involvement in the design process.

PARTS CONTROL

A Parts Control Program is an industry best practice for the selection of parts or materials during the product life cycle. The program is established to achieve life cycle cost savings, reduce parts proliferation in a product or system (including reduction of the number of part types, grades or values), minimize the affect of parts obsolescence (out-of-production parts or diminishing manufacturing sources) and improve parts interchangeability, reliability and maintainability.

A Parts Control Program will reduce product cost by knowledgeable selection and control of the componentís performance, quality, durability, maintainability and reliability characteristics. The Parts Control section describes the expectations of the customer for control of product and designs and advanced notification when components are being phased out. The supplier may satisfy these requirements according to their internal procedures or a mutually agreed upon Parts Control Plan. An example Microcircuit Parts Control Plan is attached in the complete BP Manual document.

CONFIGURATION MANAGEMENT

The configuration management process ensures adherence to customer requirements and product repeatability in manufacturing. Configuration management processes include release controls, implementing changes to design and configuration documents, subcontractor configuration management, disaster recovery planning, as-built reporting and reporting of revision status. Note: This document does not address drawing formats, which must be agreed upon by the design agent and the customer.

QUALITY SYSTEMS

The supplierís Quality System should provide for continuous improvement and variability reduction. The requirements defined in this Business Practices Manual are based on ISO-9001 or ISO-9002. Many industry groups or customers have unique quality system requirements based on ISO-9000: QS-9000 for the automotive industry, D1-9000 Advanced Quality Systems for Boeing and TS-9000 for the telecommunications industry. The Business Practices Manual is our attempt to establish quality system requirements that are acceptable to the defense customer, military contractors and commercial suppliers.

SUPPLIER SELECTION

Source Selection policies and/or procedures address the selection of qualified suppliers, performance rating systems and evaluation of past performance. The technical and cost issues involved with down-selection are not addressed in this document. The Appendices discuss (a) sub-tier supplier self-evaluations, (b) system registration levels and (c) supplier relationships.

PROCUREMENT CONTROLS

Procurement controls are established to provide clear communication of requirements, delivery and acceptance criteria. This section discusses the minimum information necessary for procurement, stresses the importance of the acceptance criteria and discusses the Government priority ratings and allocation system (referred to as DPAS). The Government customer should not require DPAS on a commercial item contract. The Procurement System evaluation (a.k.a. Contractor's Procurement System Review CPSR) requirement is established but a caution is included to make it clear to the Government customer that commercial companies normally do not permit reviews of their procurement system. The commercial suppliers are required to provide evidence of independent or internal procurement system reviews under the ISO requirements. The Appendix to the BP Manual contains a typical customer report that might be used in lieu of a procurement system audit.

CUSTOMER PROPERTY

Customer Property controls ensure customers that the property is being properly utilized and protected. The commercial supplier is usually unfamiliar with government requirements for control of customer-furnished property, including identification, care, tracing, and government property reporting, audits and disposal. They usually have the capability to control customer-furnished tooling and material that is consigned by a sub-tier supplier; but material or property which is considered sensitive, including national security, frequently cannot be adequately controlled by commercial companies. The ISO 9001 requirements do not typically require controls for this type of material or property. This is an area where both government customers and commercial suppliers must clearly understand the audit, tracking and reporting requirements and the supplierís capabilities. Tailoring of supplierís procedures in a Program Control Plan is frequently required.

HANDLING, STORAGE AND PACKAGING

Handling, Storage, Packaging and Delivery processes are necessary to avoid product damage during manufacturing or assembly and during shipment and storage. Commercial practices satisfy most cases, but unique customer requirements may require additional instructions for marking of packages, bar coding, or unusual environmental conditions. These instructions are usually found in the Statement of Objectives or contract. This is an area where a clear understanding by both parties is important.

PRODUCTION PROCESS AND CONTROL

Production process controls affect process yield. This section establishes the customer requirements for assurance that these controls are in place and functioning, with particular emphasis on controls and key characteristics.

PRODUCT SUPPORT

Product support covers issues after initial delivery to include replacement, maintenance and product warranty.

RELIABILITY

Reliability determines the cost for product warranty and the reporting requirements for the customers. This reliability information is used to market the product to potential customers and affects the product warranty and customerís product satisfaction.

Appendix C

Pricing: A Major Hurdle in Acquistion Reform”

PRICING: A MAJOR HURDLE IN ACQUISITION REFORM

R. Michael Nanzer, Michael E. Heberling, and Jane E. Dillon

The Department of Defense (DoD) is increasingly turning to commercial sector to meet its military requirements. The advantages in doing so include affordability, shorter lead-times and access to a larger industrial base. In addition, commercial firms are increasingly keepers of advanced technologies and capabilities. This is particularly true for the electronics, computers, software and communications industries.

Legislative changes directed at acquisition reform are making it easier to take advantage of the commercial sector. A major theme of the reform initiatives is to use commercial products at all tiers to the maximum extent possible in meeting military requirements. The DoD, in theory, will benefit from a very competitive domestic and international market. The underlying assumption is that market forces will ensure a fair and reasonable price. This theory holds so long as: 1. the quantities produced are large, 2. there is competition, and 3. the product is essentially "homogeneous" among various manufacturers. When the DoD requirements call for a commercial-like or military-unique product that deviates from any of these three conditions, the issue of determining a fair and reasonable price becomes a problem.

THE AIR FORCE MANTECH PILOT PROGRAM

The Air Force has an Industrial Base Pilot (IBP) called the "Military Products From Commercial Lines (MPCL)" administered by the Materials and Manufacturing Technology Directorate of the Air Force Research Laboratory. The MPCL program objective is to demonstrate the production of military components for the Air Force F-22 Raptor Fighter and the Army RAH-66 Comanche Helicopter on a commercial line at lower cost and comparable quality to those produced on a dedicated military line. The MPCL program is in a unique position to provide a preview of the commercial acquisition environment of the future. Consequently, another major objective of the program is to identify and document those policies, practices or conditions that hinder or complicate DoD access to the commercial sector.

The pilot team found pricing to be one of the most challenging issues facing the program. Although price analysis and market research are key to purchasing commercial items, the pilot team found that the government contracting community has yet to fully develop the necessary skills in these two areas. The MPCL pricing experience and lessons learned are provided here to assist other military programs as they also begin to increasingly access the commercial sector.

LEGISLATIVE CHANGES AND PRICING

The Federal Acquisition Streamlining Act (FASA), and the Federal Acquisition Reform Act (FARA) establish a preference for the acquisition of commercial items to the maximum extent possible at all levels (prime contractor and subcontractor). Procurement policy now more closely resembles the commercial market. The revised acquisition regulations require agencies to:

(a) Conduct market research to determine whether commercial items or non-developmental items are available that could meet agency requirements;
(b) Acquire commercial items or non-developmental items when they are available to meet the needs of the agency; and
(c) Require prime contractors and subcontractors at all tiers to incorporate, to the maximum extent possible, commercial items or non-developmental items as components of items supplied to the government.

The expanded commercial item definition has helped to relax a number of the reporting, compliance and oversight requirements that previously inhibited commercial access. FAR 15.804-1 expressly prohibits obtaining cost or pricing data if the contracting officer determines that the prices agreed upon are for commercial items. This includes modifications to contracts or subcontracts for commercial items. This does not, however, absolve the contracting officer of the responsibility to ascertain that the item being purchased is at a fair and reasonable price.

Although restricted from requesting *cost or pricing data* for commercial items , FAR 15.804-5 allows the contracting officer to request information *other than cost or pricing data* to the extent necessary to support a price reasonableness or cost realism determination.

The FAR establishes an order of preference for sources of pricing information with an emphasis on the least intrusive forms. If the basis for the price is not adequate price competition, the contracting officer should initially seek information *other than cost or pricing data*. The first source of information would be from within the Government. Next, in order of preference, would be from any source other than the offeror. The last (and least preferred) choice would be from the offeror.

Since there is no requirement for *cost or pricing data* when procuring commercial items, the contracting officer should perform a price analysis. The goal is to determine the reasonableness of the price and the need, if any, for further negotiation. The contracting officer should seek enough information to adequately evaluate the reasonableness of the price.

The contracting officer, however, needs to be aware of the limitations relating to commercial items. First, limit requests for sales data for the same, or similar, items during a relevant time period. Second, the contracting officer should, to the maximum extent possible, limit requests to include only information that is in the form regularly maintained by the offeror.

PRICING GUIDELINES

When procuring commercial items, the contracting officer is responsible for selecting and using whatever price analysis techniques will ensure a fair and reasonable price. FAR 15.805-2 suggests using one or more of the following pricing techniques:

- Comparison of proposed prices received in response to the solicitation.
- Comparison of earlier proposed prices and contract prices with current proposed prices for the same or similar end items. [To provide a suitable basis for comparison, the contracting officer should consider differences in specifications, quantities ordered, time for delivery, Government-furnished materials, experienced trends of improvement in production efficiency, and when these acquisitions occurred. To be valid, the buyer should also establish the reasonableness of the earlier prices before making any comparison.]
- Application of rough yardsticks (such as dollars per pound or per horsepower, or other units) to highlight significant inconsistencies that warrant an additional pricing inquiry.
- Comparison with competitive published price lists, published market prices of commodities, similar indexes, and discount or rebate arrangements.
- Comparison of proposed prices with independent Government cost estimates.
- Comparison of proposed prices with prices for the same or similar items obtained through market research.

THE DEFENSE PRICING PROBLEM

FASA and FARA greatly expanded the definition of what constitutes a commercial item. This change ended the requirement for contractors to supply *cost or pricing data* if their products are designated as commercial. However, many inside and outside the acquisition community are having second thoughts over this particular reform initiative. This is especially true in light of the increasing number of procurement horror stories reminiscent of the '80s. The following headline appeared on the front page of the November 2, 1997 issue *of Defense News*: "Did 'Reform' Boost Costs?, Pentagon Official Fears Another $700 Hammer Story." *Aerospace Daily* quotes Sen. Tom Harkin as saying "The Pentagon is allowing defense contractors to overcharge the U.S. Government by claiming that certain products are available in the commercial sector. Senator Harkin has asked Defense Secretary Cohen to work to change acquisition policy, particularly regarding what contractor products can be deemed "commercial."

This concern is misplaced. We have a pricing problem, not a definition problem. Simply stating that a product is "commercial" was never meant to imply that its price is "fair and reasonable." It is incumbent upon the contracting officer to verify that the "commercial price" is, in fact, fair and reasonable.

For several reasons, there is no turning back to the days when defense suppliers provided reams of *cost and pricing data* to support their offer. First, there are far fewer purely defense suppliers left to do business with today. Defense firms have gone out of the

business, merged with other firms, or have become more-commercial-than-military in their orientation and product lines. The most significant reason, however, is that commercial firms are unwilling or unable to comply with DoD cost or pricing disclosure requirements. They view such information as proprietary and key to their competitive advantage. They do not want to provide the DoD with this kind of pricing data to accommodate what may be a *small,* one time-customer. Consequently, reinstating *the cost or pricing data* disclosure requirements of the Cold War era is, in reality, no longer an option.

In this new environment, price analysis will increasingly replace cost analysis as the primary tool for establishing a "fair and reasonable price." However, price analysis of military items made by commercial firms, or commercial items modified for military use, is very difficult. Unless these types of products have a long history (and a high volume) of U.S. and foreign military sales, it is unlikely that there will be sufficient pricing data with which to evaluate the reasonableness of the price.

There is rarely a catalog or market price with which to compare military items made by commercial firms or commercial items modified for military use. Even with a catalog, the price analysis can be complicated. For example, catalog prices in the aerospace industry frequently represent not only the price of "one" item, but also servicing and transportation costs to support a rapid turnaround. The military services, however, will usually buy multiple spares for storage and provide their own logistical support. Consequently, it is possible for a commercial catalog price to actually be higher than the prices paid for that item before acquisition reform.

Defense buyers, in many respects, have a far greater price analysis challenge than do their commercial counterparts. As the pricing guidelines section above indicates, there are many pricing approaches to consider. The basis for most of these relies on some type of comparison (similar item catalogs, or market price). Consequently, the more divergent the military item is from an existing commercial one, the less applicable are these comparison pricing techniques.

If the military simply wanted commercial-off-the-shelf (COTS) items made by multiple suppliers in very large quantities, the pricing problem would be minimal. Unfortunately, this is rarely the case. The military tends to want *commercial-like* products (not COTS, but still commercial by the expanded definition) in small quantities with "extras" (testing, higher performance, longevity, etc.). The combination of these two factors, "small quantities" and "extras," have the synergistic effect of magnifying the pricing problem for the defense buyer.

There are two other complicating issues to address: profit and the non-recurring costs. When a commercial company embarks on a new product line, many will initially price the product at a loss. They do this for several reasons. First, they want to enter and capture market share. The second reason involves non-recurring costs. These will be significant until the volumes produced are large. Consequently, the goal is to spread these expenses over many units to minimize the impact.

What happens when a customer (military or commercial) wants a unique or customized product in small quantities? Under this situation, the supplier will price the product very differently. First, they will price it so as to fully make their profit on just this order. They do not intend to lose money in the near term for a product that may have no future market. Second, they will apply all of the non-recurring costs to just this order. This will make these products very expensive relative to a similar commercial-off-the-shelf item. The comparison pricing techniques listed above are not readily adaptable under these circumstances, that is when the DoD requires small quantities and "extras."

Higher Performance Requirements. The commercial approach is to design products for a narrower operating environment. The smaller the performance operating band, the lower the cost will be for that item. In contrast, military requirements cover greater operating environments. Unique military requirements exist because a particular component may need to work under greater extremes of temperature, humidity, or vibration than are necessary in the commercial environment. A system must be able to operate in Antarctica one day, in the deserts of the Middle East the next and in the humid jungles of central Africa on the following day. The more the requirements deviate from commercial versions, the more costly and less likely there will be a commercial-off-the-shelf solution. Commercial products (without modification) are frequently unsuitable for defense systems that have high performance requirements.

This situation suggests that the establishment of military requirements needs to go hand-in-hand with a thorough understanding of the capabilities and limitations of commercial products, technologies, and manufacturing. There needs to be a three-way tradeoff in the requirements generation process between: performance, cost and commercial availability. As a side benefit, this process will also help to mitigate the pricing problem.

Buying in Small Lot Sizes. The Cold War defense market was geared to a high-performance, high cost, low-volume production environment. Today, when the DoD turns to the commercial sector, it finds a market that largely focuses on moderate performance, low cost, and high volume production. We are starting to enter a new era of lean and flexible manufacturing. This allows companies to economically manufacture products (military or commercial) in small lot sizes. Unfortunately, producing the items in small lot sizes is only half the problem. The other half is to be able to buy the parts *that go into the products* in small lot sizes. While commercial firms do produce in small lot sizes, they produce *many* small lot sizes. This equates to cumulative large volumes that minimizes the parts buying problem. However, in the case of military products, the total volume is small. Many commercial parts suppliers have minimum order size requirements that they impose on customers. If the order is under this amount, these firms will either not sell their products or they will charge a premium for the low quantity.

We should expect future defense requirements to remain small relative to the orders of other commercial customers. Therefore, it is imperative that the DoD take steps to make the manufacturing transition from commercial products to military products as seamless as

possible. In addition to a design for manufacturing philosophy, pooling requirements across and within services whenever possible is another way DoD can take advantage of the capabilities of the commercial sector. Even though the F-22 and RAH-66 are very different systems with very different missions, commonality exists at the subsystem level. The MPCL program illustrates that by consolidating requirements, two services are able to economically leverage the commercial manufacturing process.

HOW DOES THE COMMERCIAL SECTOR HANDLE PRICING?

In the DoD there is a great deal of concern with pricing because it involves taxpayer money. However, stockholders and senior management in the private sector are just as concerned that their companies obtain fair and reasonable prices, perhaps more so. If a firm has poor procurement practices, the market is unforgiving. Overpriced products could lead to bankruptcy.

Commercial customers of one-of-a-kind products avoid unfair prices through negotiations and a thorough understanding of relative market values. Estimates of the value of a commercial product that does not yet have competitive pricing history are established using various price analysis methods. Part of the negotiation strategy is a willingness to forego certain purchases if the proposed price exceeds their estimated value.

Buyers in the private sector become very specialized in particular products and commodities. They use price analysis and market research extensively to verify price reasonableness. The commercial buyer's willingness to pay for a product is a function of not just price, but also of quality, customer service, performance and delivery. While the government sector is struggling with best value contracting, this is common practice within the private sector.

A commercial firm's end product must be competitive if it is to stay in business. Consequently, these firms will routinely assess their practices in an effort to minimize inefficiencies and remain competitive. All of the component parts must contribute to the final product's marketability. If a company finds that its end product is no longer competitive, it will take steps to reduce the product's price. There are six ways that the private sector establishes a price:

1. A request for quotes. This will help to establish a price if there is no other information available. Limit this approach to existing homogenous products made by multiple producers.
2. An established catalog or market price.
3. A customer works very closely with a supplier to design-to-cost or target price the required items. The customer and supplier firms jointly establish a more competitive price (target price) for an item. To accomplish this, they use value analysis. Together, they take steps to achieve the lower price. A long term buyer-supplier relationship

facilitates this process. Commercial buyers seek out suppliers of high-quality, low-priced products and then stay with them as long as the relationship remains beneficial.

4. A customer goes to a supplier with the following requirement: To be competitive, the customer needs item "X" (quality and other factors included) at price $"Y" or below. If the supplier cannot meet this not-to-exceed price, the customer goes on to the next supplier until finding one that can meet the requirement at the required price.

5. A customer goes to an industry leader who offers the required item at what amounts to a "take-it-or-leave-it" price. The market for leading edge commercial items is frequently dominated by monopolists. Commercial products, especially those that are state-of-the-art, will likely have features that products of competitors do not. Prices for leading edge commercial items are not likely to be supported by published catalog or market prices. This is especially true if the technology is changing rapidly as is the case in the electronics field. This is the situation that we would find in the monopoly environment. In this situation, the price may be neither fair nor reasonable. It is simply the "best price available." The buyer accepts this price because: 1. there is no alternative, and 2. its competitors face the same dilemma.

6. A buyer begins with an established market or catalog price and combines this information with any other available information to establish a foundation or base price. Using price analysis, the buyer then changes this base price up or down adjusting for technical differences (which we will assume can be priced or estimated).

Many of these commercial situations and approaches are similar to those found in the DoD. In the past the DoD was able to minimize its pricing problem by requiring cost or pricing data from its suppliers. This is, however, becoming less and less of an option. The commercial sector never did have this option. They have been forced to become very well versed in the use of market research and price analysis. With a few exceptions, the DoD has yet to establish this level of expertise. The MPCL pilot approach that follows is provided as one example to help facilitate the government learning process in market research and price analysis.

THE PILOT PRICING APPROACH

The pricing objective was to establish the price reasonableness of electronic modules built by TRW Automotive Electronics Group - North America (AEN) for TRW Avionics Systems Division (ASD) on the Industrial Base Pilot (IBP) program. The charter of the IBP program was to redesign two F-22 Communication, Navigation, and Identification (CNI) modules using commercial parts and design practices. One of the modules selected, the Pulse Narrowband Preprocessor (PNP), performs sophisticated processing of incoming signals. It then passes these signals to downstream processing elements of the F-22 CNI system. The PNP operates at very high processing rates handling large amounts of incoming signal data. As such, this module functions in a manner very similar to commercially available signal processing units.

There were five major pricing approaches to consider:

1. Comparison with another competition for same item with similar terms and conditions This was a new acquisition. Consequently, there had not been a previous buy with which to compare.
2. Comparison with another competition for a similar item -- The F-16 system was reviewed for similarities. In the F-16, the function of the PNP was accomplished by multiple systems. This arrangement precluded making a one-for-one price comparison.
3. Use of a pricing model -- A number of popular pricing models were reviewed. They all required a significant amount of training to use. In addition, a great deal of engineering interpretation was required to enter data. As a result, there could be extensive price fluctuations. The pricing model that was used to establish the PNP price was not robust. Almost any price could be justified through a manipulation of the entry data assumptions. "What price would you like?"
4. Comparison with government estimate -- The price offered by TRW AEN was already 50 percent lower than the military baseline price. The pricing exercise could have stopped right here. However, the pilot team wanted to establish a price analysis approach that would be transferable. Also, future acquisitions may not have the benefit of a government estimate with which to compare.
5. Comparison with a "similar" commercial item -- This is the approach that was pursued. The narrative that follows chronicles this pricing methodology.

Market Research

Research into the commercial DSP market has shown that it operates similar to many high technology electronic markets. Product prices reflect not only the recurring costs to produce the item, but also the amortization of non-recurring research and development costs. This manifests itself in higher prices for new technology items upon initial product introduction and a downward price trend as new product innovations are brought to the market. It is, therefore felt that the 3% price difference can be attributed to these factors which differ from the environment most military products are developed in. In the military market, a supplier's non-recurring research and development costs are typically paid for separately by the customer. This leaves the recurring production cost of military items composed solely of the recurring costs to produce the item.

The commercial DSP market is highly competitive, with numerous firms supplying standard products. Prices in this market are stable with a slight downward trend, reflecting the growth in commercial application uses. The IBP modules, as demonstrated earlier, share many of the same drivers of price with this market. This was true in terms of functionality, labor content, and sales volume. This establishes the basis for determining that a significant portion of the IBP module price is fair and reasonable, given the similarities to a robust commercial market.

Similarities Between IBP and Commercial Modules

IBP modules for the F-22 CNI application are similar to commercial digital signal processing modules in many respects. The IBP modules rely on Texas Instruments digital signal processors (DSP) to take incoming analog signals and convert them to digital data that can be processed and stored for later use. This function is identical to the commercial use of DSP that also takes analog signals like video input signals and converts them to digital data which can be stored for later use. The IBP team selected one commercial DSP firm to base it price comparison on after conducting market research using the internet, electronics trade journals, and discussions with design engineers. This firm's product line features high performance signal processors used in a variety of applications such as:

- Digital Receiver Subsystems
- Medical, Photographic, IR, & CCD Imaging
- Radar, Sonar
- Telecommunications
- Test Instrumentation, Data Acquisition

Areas of Similarity

1. Functionality - Digital signal processing (DSP) is the ability to convert and process continuous analog signals into digital signals that can be understood by conventional data processing technology. This function, while considered a necessity for avionics applications, has found commercial application in areas such as telecommunications, test instrumentation, data acquisition, and medical imaging (photographic and infrared). The signal complexities and processing differ between the typical military or avionics application of DSP and DSPT's commercial applications. These differences drive the military users of DSP to the use of more complex circuitry and more expensive component parts. Primary among the higher cost parts are the ASIC components. These parts perform the unique signal processing requirements in the avionics application, and are more expensive because they are built to specifically address the avionics requirements. This reduces the volume demands for ASIC components while driving up the price.

2. Packaging - Commercial DSP modules from DSPT are packaged using a mixture of surface-mount (parts mounted on the surface of a printed wiring board) and through-hole (parts inserted through holes in a printed wiring board) technology. The IBP modules rely solely on surface-mount technology which is more expensive in many respects. Surface mount component parts are more expensive, as are the printed wiring boards (PWB) that hold the parts. Also, the equipment and processes required for assembling surface-mount parts on the PWB are more expensive. These factors are price drivers for the IBP modules when compared to the commercial DSP packaging techniques. The military avionics built by AEN for IBP rely exclusively on surface mount components and are packaged in the Standard Electronic Module (SEM) format. This SEM format is smaller than most commercial formats and therefore drives the

military DSP user to design tradeoffs that favor miniaturization of functions. Commercial DSP applications are less sensitive to size and weight, and therefore can accommodate lower cost packaging technologies.

3. Material Content - The price drivers in commercial DSP are the DSP chips and the memory devices. Large, well-capitalized firms such as Texas Instruments (TI), a market leader, typically develop the DSP chips. TI has invested heavily in several generations of DSP chips in anticipation of an explosion of application uses. These are similar to that seen for the preeminent data processing chip maker Intel and its personal computer chips. The application use rate for DSP remains shallow when compared with that of Intel's market, and therefore the price for DSP chips remains somewhat high. Additionally, as previously mentioned, the military modules incorporate ASIC components for custom processing functions. ASIC components cost more that standard integrated circuits because they are customized for the application. Other material cost drivers include the printed circuit, and the general use of rare materials to reduce weight and provide for the better thermal and shock handling characteristics. The rare IBP materials include aluminum-infiltrated carbon for the module covers and epoxy composites for the PWBs. These materials are non-standard and therefore drive a higher price for IBP versus the commercially available modules.

4. Labor Content - Commercial DSP boards are built on automated assembly lines in low to medium volume. The IBP modules were redesigned to be built on an automated assembly line. Both products, therefore have similar labor content in their price.

5. Sales Volume - AEN bases its price on a build of 75 PNP and 41 RF-FEC modules. This volume is well below the volume AEN builds for other customers. This has a negative impact on the material cost. Due to the low volume, AEN could not obtain discounts for the majority of the components. Commercial DSP modules from DSPT are typically built to stock in low-medium volume. Scale economies due to volume are seen most predominantly in the material cost. The typical material content of DSPT module represents 25% of the price. In contrast, the typical IBP material content accounts for 55-60% of the price.

Price Comparison

The Commercial DSP module is produced to a standard configuration with a range of 2-channel to 16 -channel signal analysis capability. The Commercial DSP configuration closest to the IBP PNP is the 8-channel unit that sells for $16,990.

The IBP PNP module has: a digital signal processor, eight megabytes of (SRAM), one megabyte of erasable programmable read only memory (EEPROM), and five megabytes of flash memory. The PNP also has additional processing capability from 12 application specific integrated circuit (ASIC) components used to perform custom processing functions. These ASIC components are significant price drivers of the IBP modules. The price for the IBP PNP unit is $16,525. The 3% price difference between the commercial

DSP unit and the IBP PNP module is explained by the fact that the commercial unit includes amortized development expenses. The IBP PNP development expenses were paid as part of the pilot program, and therefore are not amortized into the unit price.

Based on this analysis, the team concluded that the price offered by TRW AEN was fair and reasonable.

CONCLUSION AND LESSONS LEARNED

The Military Products From Commercial Lines pilot was ruled a commercial item acquisition by the contracting officer. This significantly reduced the number of terms and conditions associated with this procurement. The contracting officer must now establish the fairness and the reasonableness of the contractor's offer without the benefit of cost or pricing data. The MPCL pilot found that the price analysis of "military-unique commercial" items is very difficult. There is no easily identified catalog or market price with which to compare. In addition, commercial firms will not provide cost or pricing data, nor will they accept TINA and CAS disclosure requirements. Until the government becomes well versed in price analysis and market research, this will continue to be a major obstacle in the adoption of commercial practices. The following MPCL lessons learned are provided to aid in the price analysis education process.

- Move away from pricing point estimates to the use of pricing band estimates.
- Ask what goes into the commercial catalog price. This price frequently includes servicing and premium transportation fees, which the DoD customer probably does not want.
- Do not forget to consider the non-recurring costs.
- The more a product deviates from a COTS item, the more the price will increase.
- Small quantities equate to a large pricing problem.
- Pool requirements whenever possible for different subsystems within and across services.
- Do market research to maximize the use of COTS items in the requirements generation phase.
- Involve all interested parties early in the design phase to make cost, performance, and commercial availability trade-offs.
- A team effort between the government engineers and contracting officers facilitates price analysis.

- Simply calling an item commercial does not mean that its price is fair and reasonable.

- Defense buyers must now learn to deal with a new concept: “best price available."

- There is a clear need for better training in market research and price analysis techniques.

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ABOUT THE AUTHORS

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Appendix D

MPCL Commercial Item Determination Lessons Learned

MPCL Commercial Item Determination

Jane Dillon, Wright Lab Contracts Negotiator

Mary Kinsella, Wright Lab Manufacturing Technology

ìMilitary Products From Commercial Linesî (MPCL) is an Air Force Industrial Base Pilot (IBP) program administered by the Manufacturing Technology Directorate of Wright Laboratory. The program (ref. Contract number F33615-93-C-4335) is contracted to TRW Avionics Systems Division (ASD) and subcontracted to TRW Automotive Electronics Group North America (AEN). The program objective is to demonstrate the production of military components on a commercial line at lower cost and comparable quality to those produced on a dedicated military line. TRW AEN will produce military electronic modules compatible with the F-22 Raptor Advanced Tactical Fighter and the RAH-66 Comanche Helicopter on their manufacturing line which also produces commercial electronics, e.g., for General Motors and Caterpillar. The MPCL program provides a preview of the acquisition environment of the future, i.e., the use of quality commercial manufacturers for defense related products through streamlined acquisition procedures compatible with best commercial practices. This paper describes the process followed by MPCL to obtain commercial item status for the demonstration modules, thus allowing a simplified subcontract with the commercial supplier.

With the promise of the Federal Acquisition Streamlining Act (FASA) of 1994 and its attendant emphasis on using commercial items to meet government requirements, MPCL was poised to reap the Actís many benefits. In May 95, the programís Contracting Officer requested a legal determination from the cognizant Judge Advocate General (JAG) Office as to the commerciality of the electronic modules. Since FASA had not yet been implemented, the proposed rule issued pursuant to FASA (FAR Case 94-790: Acquisition of Commercial Items) was used as the basis for the request. The justification presented was that, prior to this contract, TRW AEN only performed work for non-governmental customers and their production items are of a type customarily used for non-governmental purposes. Therefore, since the military electronic modules would be manufactured using the same processes, the same equipment, and the same workforce, they meet the criteria that the items be of a type customarily used for non-governmental purposes and sold to the general public. The proposed rule also allowed for ìminorî modifications that do not alter a commercial itemís function or essential physical characteristics. These electronic components do not share all the traits of those manufactured for AENís commercial customers, either functionally or in physical characteristics. However, allowance was made in the proposed rule for modifications of a type customarily available in the commercial marketplace, and TRW AEN does routinely tailor its products to specific customers.

The MPCL team provided yet another perspective, that AEN is a commercial contractor which offers products to several automotive companies. Each component AEN sells to its customers is unique, however, because each requires a different ìform, fit and function.î Consequently, the common product which is sold to the public, and now to the Government, is the design, development, and production of a part.

In a negative response to this request, the JAGís position on 18 May 1995 was: 1) to apply a proposed rule under FASA to a subcontract not agreed to under FASA was premature; 2) this agency, the Manufacturing Technology Directorate, had not planned for acquiring commercial items early in the procurement process; 3) the nature of the prime contract (cost reimbursement, research and development) prohibits the application of commercial items, irrespective of the subcontract type; and 4) there was no clear indication that the benefits of FASA were ever intended to apply to other than new efforts.

When FASA was implemented in Oct 1995, a notable addition was inserted into the definition of ìminor modificationî, as follows: ì.....*modifications that do not significantly alter the non-governmental function or essential physical characteristics of an item....**or change the purpose of a process.î*** The intent of this inclusion seems to be that the authors recognized that a common practice in the commercial sector is the modification of products to meet individual customer needs. A logical conclusion can be reached that if a customerís products can be made with existing commercial manufacturing processes (with minor modification to same) then under this commercial item definition, it is a commercial item.

Following the implementation of FASA, the MPCL team conducted a thorough review of the acquisition planning and strategies that facilitated award of the MPCL contract. Interim and final rules implementing recent acquisition reform legislation were also analyzed. The team found that many of the earlier JAG concerns were no longer issues. The team concluded:

A) 1) The guiding principles in the Federal Acquisition Regulations (FAR) explicitly empower Contracting Officers to make decisions within their area of responsibility, and in so doing, to assume that, if a specific strategy is in the best interest of the Government and not addressed in the FAR nor prohibited by law, that the strategy is a permissible exercise of authority. In support of this position, the Comptroller General found, in *Komatsu Dresser Co., Comp. Gen. B-255274,94-1CPD P119,* that the *ìdetermination of whether a product is a commercial item is largely within the discretion of the contracting agency, and will not be disturbed by our Office unless it is shown to be unreasonable.î*

B) 2) The Manufacturing Technology Directorate had conducted a market research that identified a need for advanced research into ways to move the DoD into commercial item acquisition. TRW ASD proposed a program which fulfilled this need by a technical demonstration of commercial manufacturing process capability to produce military weapon system components. Also, in essence, TRW ASD had performed a similar market research, and identified AEN as the F-22 component supplier for this demonstration.

C) 3) FASAís preference for commercial items where possible clearly extends to sub components, and subcontracts under which those subcomponents are supplied, and TRW ASDís business arrangement with AEN is under a Firm Fixed Price (FFP) subcontract.

D) 4) The interim FAR rule, issued April 1996 encourages appropriate modifications of existing contracts to incorporate other changes authorized by FASA.

In the meantime, TRW had prepared a determination that their subcontract was one supplying commercial items. Based upon these findings, the Contracting Officer endorsed TRWís commercial item determination. This endorsement was resubmitted for legal review and comment in August 1996, and was found to be legally sufficient.

Barriers and Opportunities with Using Commercial Suppliers

Mike Heberling, Ron McDonald, Mike Nanzer, Eric Rebentisch, and Kim Sterling

Recent government initiatives have sought to significantly reduce acquisition costs by using more commercial, instead of military-unique, practices and technologies. One pilot program specifically designed to leverage the commercial electronics manufacturing base is the Military Products From Commercial Lines (MPCL) program. The mission of the MPCL program is to demonstrate that high technology military hardware can be built on a highly automated commercial production line, with equivalent durability, functionality, and reliability, and at a significantly reduced price. This article will discuss experiences to date in producing military products from commercial lines, as well as the results of two surveys of commercial industry (one in-depth, the other broad-based) to identify commercial manufacturers' receptivity to producing military products on their production lines.

The MPCL program is a 4-year Industrial Base Pilot sponsored by the Air Force Research Lab, Manufacturing Technology Division. TRW Avionics Systems Division is the prime contractor, supported by the TRW Automotive Electronics Group - North America. The MPCL team has developed a methodology for partnering with commercial suppliers that encompasses process technology enhancements, improved manufacturing infrastructure flexibility, and streamlined business practices. The pilot program is approximately 80% complete, and the program team has added to its knowledge base through recently completed market research that attempted to test the transferability of the military products from commercial lines concept to the commercial sector.

As shown in Figure 1, under the MPCL program, avionics modules for the Air Force's F-22 Raptor Fighter Aircraft and the Army's RAH-66 Comanche Helicopter have been redesigned using largely commercial-off-the-shelf parts. A computer integrated manufacturing (CIM) system has been implemented at the TRW Automotive Electronics Group's Marshall, IL. plant to ensure that there is minimal line interruption due to set-up and changeover between military and commercial products. A rigorous component reliability program has been implemented and "design-of-experiment" testing programs have been conducted to prove that the redesigned hardware will be as durable and reliable as the baseline military hardware. Most important, in light of the government's attempts to reform military acquisition processes, the MPCL team has established a process for acquiring the military-unique modules as commercial items, relying on price analysis instead of cost analysis. The Air Force and Army program beneficiaries have realized greater than 50% cost avoidance over the baseline military versions of this hardware. Additionally, the technology to enable the commercial redesign of additional F-22 modules has been transferred to enable addition recurring cost reductions.

Key facilitators for the MPCL success in implementing a commercial contract for military-unique modules have been the development of a business practices handbook and commercial model contract. The handbook is a performance-based replacement for canceled military standards that was developed using integrated teams of both military and

commercial sectors. This teaming approach helped to ensure that practices outlined in the handbook are both acceptable to TRW's commercial automotive group, and also satisfy the military's requirements. The requirements in the handbook can be applied in a cafeteria style, tailored to the individual procurement. The requirements include industry best practices, government best practices, and non-government standards such as ISO-9001. The model contract is similar to contracts used in TRW's commercial automotive business.

Going Beyond Demonstration to Transfer - Market Research Surveys

Having demonstrated the benefits of military products from commercial lines, the program team turned its attention to transferring the technology to industry. A key part of the MPCL strategy is to transfer the benefits of military products from commercial lines by transitioning the processes used to acquire these products. To do this, the team recognized that additional commercial industry input to the handbook and model contract was necessary. The team established two surveys to obtain this input; a requirements validation survey done with a small number of commercial electronic manufacturing service (EMS) firms, and a commercial impact survey of over 1,340 EMS and printed wiring board (PWB) companies.

Market Research - Business Practices Requirements Validation Survey

To validate the transferability of the military products from commercial lines concept, the team constructed a validation survey process that was modeled after a typical commercial transaction for EMS services. The team used internet searches and industry trade journals to identify the major EMS industry firms. The MPCL team constructed a request for quotation package (RFQ) which included the business practices handbook requirements, the model contract terms and conditions, and a representative build and test quantity of IBP modules. A full technical data package was provided to each participant, although the team provided the same material pricing data to each firm to avoid needlessly exercising component suppliers. In addition to asking for pricing information, participants were also asked for qualitative feedback on the producibility of the commercial redesign and the commercial acceptability of the handbook and model contract.

To date, all five of the planned surveys have been completed, which involve a half-day business meeting to review supplier comments, and a brief plant tour. Participants were told that the purpose was research only, and the RFQ package would not result in a contract. Additionally, participants were offered compensation for their participation, however, each one participated voluntarily. Many of the firms related that the benchmark pricing data that was provided to the participants was well worth their time in putting together survey responses.

A cross-section of the EMS industry was included in the survey; from very small (<$30M / year sales) to very large (>$1B / year sales) firms. The firms identified as ovals in Figure 2 are the primary validation participants who provided quantitative and qualitative feedback,

and accommodated a site visit. The other firms represented on the map either provided pricing information, or handbook and model contract feedback.

The results from the requirements validation survey were important in that they suggest that many of the key aspects of the MPCL process are transferable to other commercial firms. Figure 3 shows how the participants rated the acceptability of the MPCL requirements handbook. Of the total 76 requirements in the handbook, 53 (or 70%) were acceptable. Seventeen requirements (or 22%), while acceptable, would add cost. Only 6 requirements (8%) were considered unacceptable to the validation participants. Comments from the participants will be used to help modify those requirements that add cost or were unacceptable to make them commercially acceptable in a future revision to the handbook. This will be done with the consensus of the original team that developed the requirements. It will also be reviewed by key validation survey participants. The 17 cost adding and six unacceptable requirements are shown in Table 1. Note the lack of consensus among the participants on these requirements. Notification of Product Phaseout was a problem for one EMS firm, due mainly to the fact that it does not have a design capability. Its position is that the designer should know more about the product life than the manufacturer. This firm did indicate that it would perform this function for a customer with whom it had a strategic alliance. This was a common theme for many suppliers. They are just as particular about their customer bases as many customers are about their supplier bases. This situation suggests that the DoD may want to revisit its role as a customer in the commercial sector.

Three suppliers were opposed to flowing down requirements to subcontractors. They did not view this as a commercial practice. Cost of Quality reporting was also a problem for three firms. The process is deemed to be obsolete by these firms, and has been replaced by Statistical Process Control (SPC) and real-time process monitoring capabilities. The Defense Priorities and Allocation System (DPAS) was the requirement that garnered the most disapproval from the participants. EMS firms do not want government involvement in the prioritization and scheduling of their factories, as is required by DPAS. One firm also expressed concern regarding the reliability program requirement. This would obviously apply only to firms doing some design work; again, one of the participants has no design function.

Table 1 also provides the cost-adding requirements identified by the EMS suppliers. It is important to note that these firms are positioned to accommodate unique customer requirements. So, some would argue that they do not represent a good industry for testing the acceptability of a new set of replacements for military requirements. These concerns were discussed with each participant and the consensus feedback was that requirements accommodation occurs in all industries, dependent upon the level of customer commitment.. That is firms will do what you want, if you commit to a long-term relationship. Many of the MPCL requirements were acceptable to the participants if they came from a strategic customer. However, for a one-time customer, these requirements were identified as out of the norm, and therefore viewed as contributors to cost. The MPCL team did not endeavor to get participants to provide the level of cost added for

each requirement. Universally, they agreed that this varies from customer to customer, again, depending on the nature of the relationship. Some of these may be done for some customers without additional cost. This suggests that military customers with fiscal-year funding constraints would have difficulty dealing with commercial suppliers from these industries. The lack of multi-year funding associated with most military programs is seen as a key barrier to commercial-military partnerships.

Of particular interest among the cost adding requirements are Customer Verification at Production Verification with Physical Configuration Audit, Customer Verification at Manufacturing Readiness Review with Functional Configuration Audit, In-process Inspection Witnessed By Customer, and Final Acceptance Inspection witnessed by Customer. Each of these requirements involves the customer in the supplier's production process. In general, the participants expect these, accommodate them, and only a small percentage of them charge customers extra for them. In other words, it is acceptable commercial practice to accommodate customer audits and inspections. The key distinction here is customer. The commercial world generally does not have the equivalent of the military's large customer structure. The type of audits and inspections were talking about here are those done by the direct customer (not DCAA, not DCMC, and not prime contract representatives).

The real measure of the transferability and acceptability of the MPCL commercial redesign, and streamlined business practices is measured by the pricing data received from participants. Figure 4 shows a fairly tight distribution of pricing submitted by the validation participants. The average price represents a 68% savings over the military baseline cost for the F-22 and RAH-66 versions of these modules. A standard deviation at less than 20% of the average price attests both to the competitive nature of this market and the transferability of the MPCL commercialization approach.

The MPCL validation survey demonstrated that several commercial suppliers could build the redesigned military hardware at a competitive price. The team was initially concerned that the low volumes associated with military products would be a deterrent to many of these firms. There were a few very large firms who declined to participate because of the volume associated with a military product. However, most firms look at the level of customer commitment in total, not at just one individual business opportunity. Strategic alliances and partnerships are important in the EMS industry. This emphasis on partnerships in the commercial sector runs counter to the standard government practice of funding programs on a fiscal year basis. Commercial firms prefer to deal with customers who can commit to a long term relationship.

Interestingly, the general feedback was that the commercial model contract was too favorable to the customer and was largely unacceptable to the suppliers. It is important to note that the MPCL team used typical commercial automotive industry terms and conditions. This indicates that there are also business practices in commercial contracts which are not universally acceptable. These practices will be revised based on the feedback of the validation participants to ensure a win-win contractual approach.

Market Research - Commercial Impact Survey

To get a better sense of the commercial electronics suppliers' general understanding of the impact of recent acquisition reforms, and to gauge their willingness to bid on military business, the MPCL team conducted a broad-based survey of both the EMS and PWB industries. This research was designed to cover issues not addressed in two previous Coopers & Lybrand surveys focusing on commercialization barriers, as well as highlight areas where additional acquisition reforms may be necessary.

Participating in the survey with TRW were the Institute for Interconnecting and Packaging Electronic Circuits (IPC) and the Massachusetts Institute of Technology (MIT). IPC Director of Market Research Kimberly Sterling provided access to the member and non-member mailing lists for both the EMS and PWB industries. The MIT Lean Aircraft Initiative (LAI) representative on the team was Dr. Eric Rebentisch, who received all the completed surveys and tabulated and analyzed results. Anteon Corporation researcher Dr. Michael Heberling assisted TRW's Ron McDonald and Mike Nanzer and the other team members with the survey questionnaire content. The survey received an 11% (153/1340) response rate, which is good for a cold-survey like this, according to IPC, which frequently surveys its membership firms.

Prior IPC surveys show that the EMS industry (a $14B US industry in 1996) earned only 2% of its CY 1996 sales from government customers. Our data agrees with that percentage. Because of data collection limitations, we can't conclude whether that number has changed appreciably in the time period since major acquisition reforms were enacted.

The survey also sought to establish:

- Are commercial suppliers aware of the significant changes made by the government in acquisition reform. The Federal Acquisition Streamlining Act (FASA) and the Federal Acquisition Reform Act (FARA) hold great promise for increased sales to the government by commercial firms. Are suppliers aware of this?
- And further, if they are aware, are they even interested in doing government work?
- Do they see the military as a potential strategic customer?
- What are the barriers that prevent more commercial involvement in military programs?

The survey participants indicated that the word is not getting out on acquisition reform. While the majority (65%) have heard about military specification and standard cancellation, only 10% were aware of the contractual changes (FASA and FARA) that would seem to offer the best inducement for increased partnering between commercial suppliers and military customers.

Contractual barriers to commercial access were also addressed by the survey. A number of other studies have focused on the defense contractors' view on barriers to using commercial suppliers (see for instance, the TASC/Cooper's and Lybrand report, "The DoD Regulatory Cost Premium: A Quantitative Assessment", December 1994). In

contrast, this survey addresses only commercial firms. The bar chart in Figure 5 ranks such contractual practice barriers as cost accounting standards, truth in negotiations, and unique reporting requirements. The chart shows the ranking of barriers that either add cost if complied with, or are unacceptable barriers to commercial access by military customers. The most significant observation in Figure 5 is that commercial suppliers are adamantly opposed to any restrictions on their profitability imposed by government contracting regulations. Other practices considered unacceptable by many of these commercial firms include the imposition of government cost accounting standards and the requirement for cost and pricing data. These, of course, all represent significant deviations from general practice in the commercial marketplace.

The findings also indicate that many of the government's requirements eliminated by expansion of the commercial item definition (barriers such as CAS and TINA) are still perceived as barriers by commercial suppliers. As a result of FASA and FARA, commercial item suppliers should no longer be holding up CAS and TINA as barriers on commercial item contracts. This situation suggests there is an education problem. It can't be determined from this survey whether the problem lies with the commercial supplier who is not seeking this information, or with the military customer who is not implementing the changes brought about by FASA and FARA. But clearly, the ground breaking changes that are in place due to FASA and FARA have not filtered down to the commercial suppliers who would seem to be among their primary beneficiaries.

The survey also asked the participants to rank technical barriers to doing military contract work (see Figure 6). Technical barriers include such items as special test, quality, and reliability requirements. One notes immediately that significantly fewer suppliers consider technical barriers to be unacceptable when compared with the contractual barriers shown in Figure 5. Though this may seem like good news, it still reinforces the idea that while commercial suppliers are willing to contract for commercial work, the military customer will have to expect to pay higher prices for any unique specifications, regulations, or oversight that it chooses to impose. This suggests that some of the beneficial cost reductions the DoD had hoped to realize through using the commercial supplier base will not occur if the military customer itself doesn't fully embrace general commercial contracting and oversight practices. Those practices ranked most frequently as unacceptable by the survey respondents include special operational test requirements, in-process source inspection, and physical configuration audits.

The data in Figures 7 and 8 show that smaller firms, and firms specializing in low-volume, high-mix products are more likely to consider DoD sales "vital" than do larger firms. This suggests, perhaps, that military products don't provide enough of a revenue stream for large, high-volume firms with large capital asset structures. While this may preclude the firms with the greatest scale economies from producing defense products, it does indicate clearly where DoD contract solicitation and education efforts should be directed. Additionally, the firms most likely to see DoD sales as vital are producing products in low to medium volume, with a medium to high mix of products. This is important, in that most DoD customers have a high mix of low volume products. So the good news is that

there is a segment of the commercial market that is interested or potentially interested in DoD work, and can bring the DoD many of the advantages it is looking for in commercial items - specifically lower cost, quicker time to market and higher quality levels. The bad news it that commercial suppliers do not realize that significant changes have taken place which now makes doing business with the DoD far more attractive.

The data showed that the biggest EMS and PWB firms were generally not interested in DoD work, while small firms showed the greater interest levels. It is important to note that among the many streamlining measures enacted by the US government, the area of small business preference was largely unchanged. So a good match would appear to be in place for military customers looking to "go commercial" and small commercial suppliers.

Conclusion

The MPCL team's experience with the requirements validation surveys conducted with EMS firms highlight the importance of customer-supplier partnerships. Commercial suppliers are much more likely to cater to those customers who can provide long term commitments. Military customers wishing to engage in such partnerships must find ways of overcoming the fiscal year funding constraints of military programs. Participating EMS firms in the validation surveys also indicated that the military-unique MPCL modules are producible. This indicates that the use of commercial parts and practices by military customers is a key tool for gaining access to the commercial supplier base. The resulting prices bid by the EMS participants validated the significant cost savings potential of the military products from commercial lines concept.

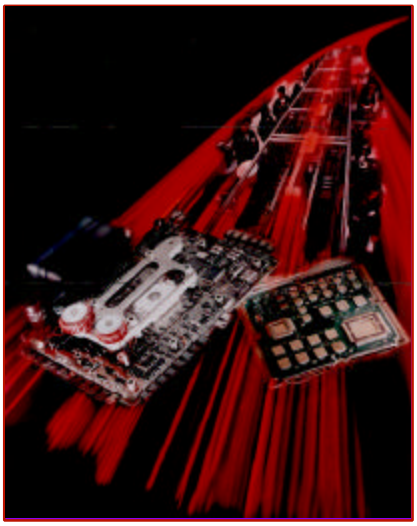
The broad-based survey's results can be summarized with three key findings and one important message for military contractors. First, smaller commercial firms may be a better fit with military customers. They are better because they appear willing to do military work and can offer increased flexibility along with the cost savings desired by the military. They also offer the benefit of assisting the military customers' socioeconomic purchasing objectives.

Second, the commercial supplier base still perceives barriers in place to doing military work. They feel that many of the contractual barriers are unacceptable and therefore deal-breakers, while technical barriers primarily just add cost. This is important for military buyers to recognize as they increasingly attempt to access the commercial market.

A final point to be made is that a mixed message on knowledge of acquisition reform was evident from the survey results. Apparently the word is out on knowledge of the cancellation of large numbers of military specifications and standards, due largely, we think, to the press coverage for former Defense Secretary Perry's initiative in 1994. However, the streamlining measures that stand to offer commercial suppliers the greatest access to military work (FASA and FARA) are largely unknown to these suppliers. Is this the military buyer's fault (failure to educate the supplier base, failure to implement FASA and FARA including market research, commercial item preference, etc.)? Or is it a failure of the supplier to learn more about their changing customer environment? A key lesson

from this survey is that both DoD customers and suppliers can benefit from basic market research. The partnerships necessary for the future success of commercial item acquisitions by DoD customers depend on both parties understanding the new rules of the game.

The Concept - Leverage the Commercial Electronics Manufacturing Base for Cost Reduction



FEATURES

- Exploit Proven Quality and Cycle Time on High Volume Commercial Lines
- Design for Manufacturability AND Commercial Practices
- Maximize Adoption of Best Practices via Team-Based Approach

BENEFITS

- 30-50% Cost Savings for F-22 and RAH-66 Electronic Modules
- Demonstrated Manufacture of Military Modules using Commercial Processes and Practices
- Process and Model for Subcontracting to Commercial Suppliers

Figure 1. Key Features and Benefits of MPCL Concept

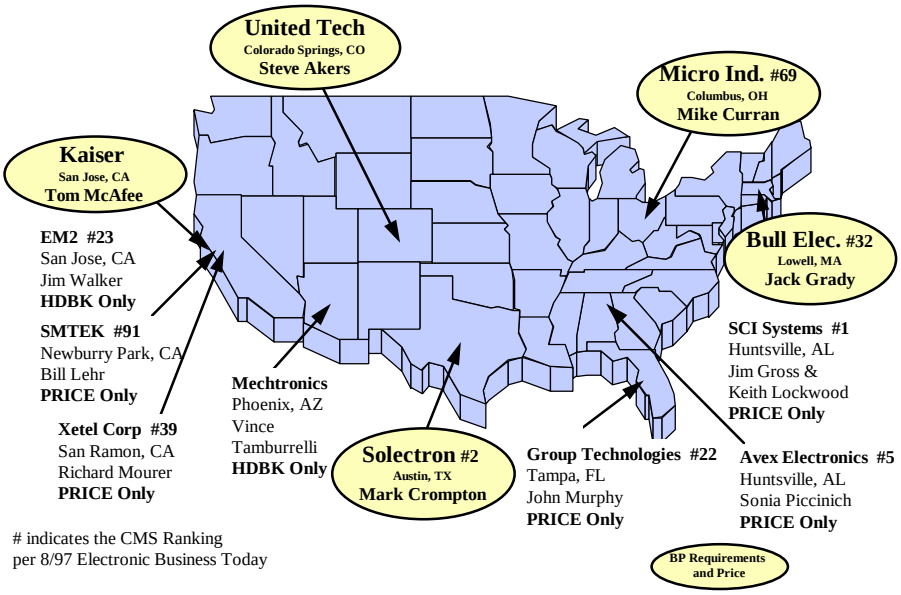


Figure 2. Requirements Validation Survey Participants

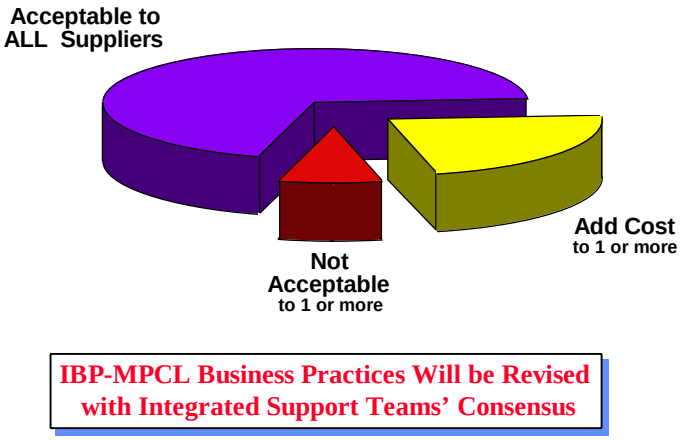


Figure 3. Handbook Requirements Validation Survey Results

7 Specific Requirements Determined To Be Cost-Adding By Participants

7.1 Requirement Description	7.2 No. of Firms
7.3 Operational Requirements Matrix	7.4 1
7.5 Program Control Plan	7.6 1
7.7 Customer Verification @ Manufacturing Readiness Review w/ Functional Configuration Audit	7.8 1
7.9 Customer Verification @ Production Verification w/ Physical Configuration Audit	7.10 2
7.11 Parts Control Program	7.12 1
7.13 Configuration Status Record	7.14 1
7.15 As-Built-Configuration Report	7.16 1
7.17 Functional Configuration Audit (see #12 above)	7.18 1
7.19 In-process Inspection Witnessed by Customer	7.20 1
7.21 Final Acceptance Insp Witnessed by Customer	7.22 1
7.23 Control of Non-Conforming Product	7.24 1
7.25 Customer-Owned Property (Tracking/Reporting)	7.26 1
7.27 Bar Code Symbology	7.28 1
7.29 Reporting of Manufacturing Process Controls	7.30 2
7.31 Control of Process Parameters & Key Characteristics	7.32 1
7.33 Reliability Program	7.34 2

7.35 Product Failure Reports	**7.36 1**

Specific Requirements Determined To Be Unacceptable By Participants

7.37 Requirement Description	**7.38 No. of Firms**
7.39 Notification of Product Phaseout or Process Change	**7.40 1**
7.41 Subcontractor Flowdown of Configuration Mgmt	**7.42 3**
7.43 Cost-of-Quality Demonstration or Reporting	**7.44 3**
7.45 DPAS Ratings on Purchase Orders	**7.46 4**
7.47 Customer Property Recording & Reporting	**7.48 1**
7.49 Reliability Program	**7.50 1**

Table 1. Requirements Survey Feedback - Unacceptable and Cost-Adding Requirements

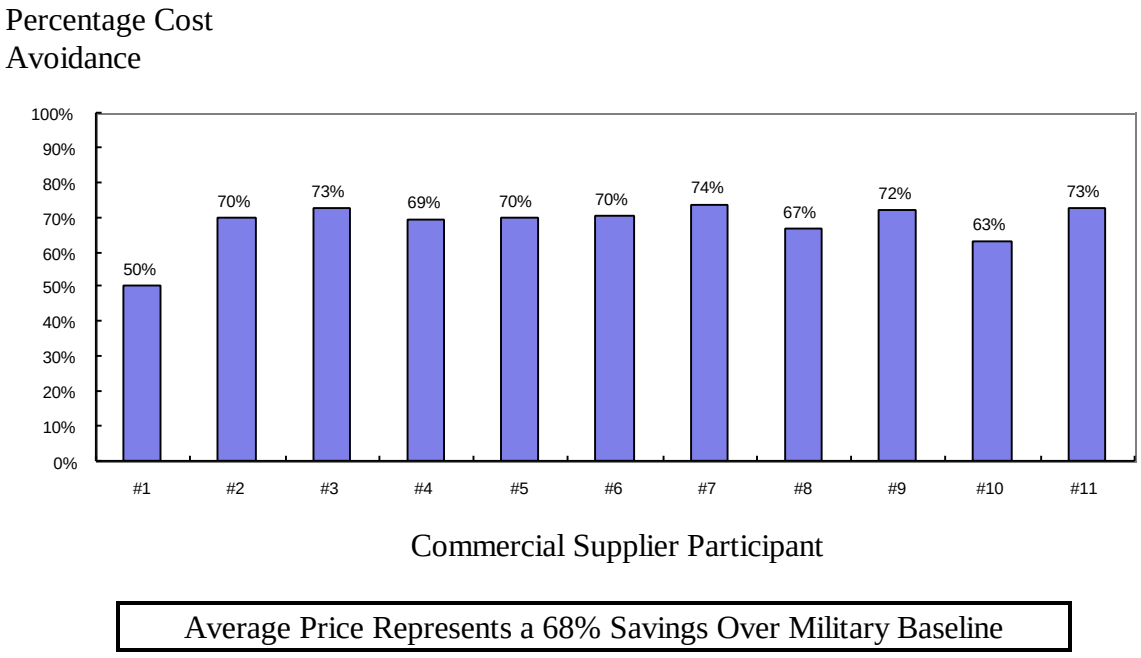
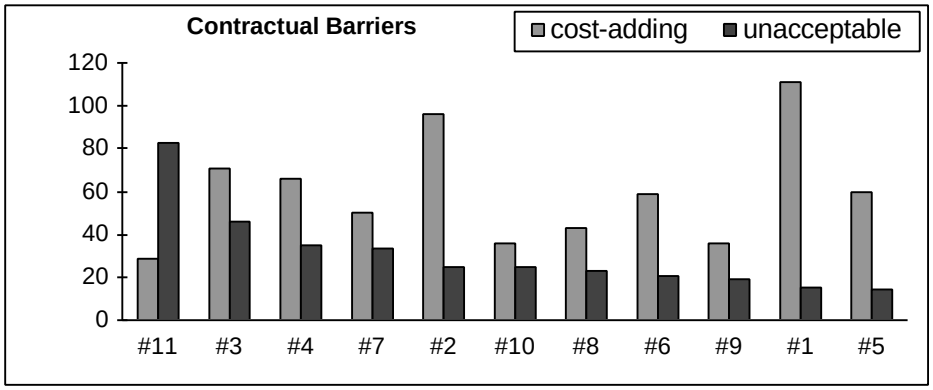
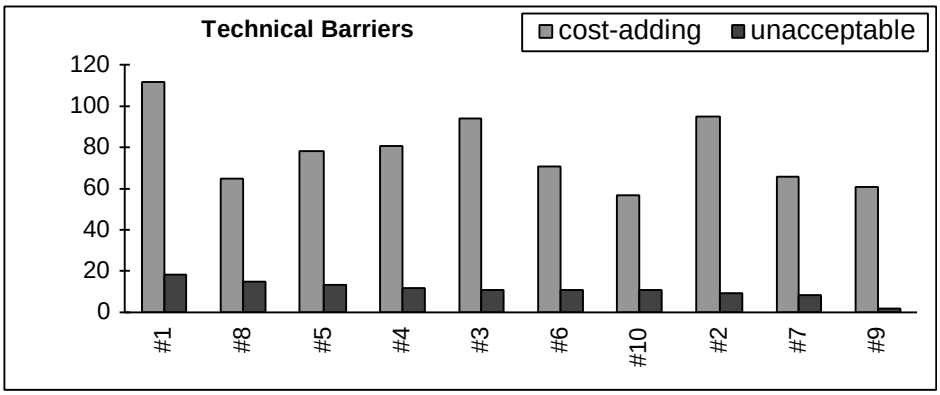


Figure 4. Requirements Validation Pricing Validates MPCL Savings Potential



#1	Government unique specs and stds
#2	Government reporting requirements
#3	Government cost accounting standards
#4	Government audits of accounting, purchasing, etc.
#5	Contract terms and conditions
#6	Defense market volatility
#7	Cost and pricing data
#8	Data/intellectual property rights issues
#9	Restrictions to off-shore fabricators
#10	Socioeconomic provisions
#11	Profitability restrictions

Figure 5. Ranking of Contractual Barriers by Commercial Firms



#1	Special operational test rqmts
#2	Quality requirements/stds
#3	Reliability or qualification test results provided to customer
#4	Flow down of requirements to subs
#5	Physical configuration audits
#6	Functional configuration audits
#7	First article inspection
#8	In-process source inspection
#9	Small lot quantities
#10	Final acceptance customer source inspections

Figure 6. Ranking of Technical Barriers by Commercial Firms

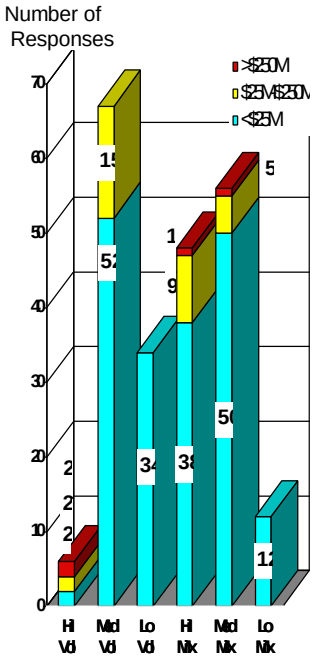


Figure 7. Commercial EMS and PWB Firm Sales Volume/Mix Data

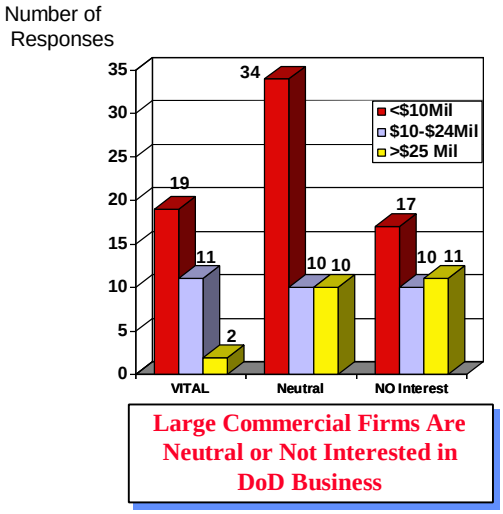


Figure 8. Interest in DoD Business by Firm Size